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SUMMARY

The performance of a two-stage, high-pressure-ratio fan having large part-span vibration dampers on the first-stage rotor is presented. The same fan with smaller dampers had been tested earlier. Apparently, high stresses in the root region of these small dampers caused them to fail. The first-stage rotor blades were then refabricated to the same aerodynamic design but with larger dampers. The use of these larger dampers significantly affected the performance. Comparisons of the performances of the two fan configurations shows that the use of larger dampers (1) produced very high losses in the damper region, which reduced the overall efficiency of the first-stage rotor by approximately 3 points, (2) did not significantly alter the overall performances of each blade row downstream of the damper, although appreciable differences in the radial distributions of various performance parameters were noted, and (3) decreased the overall fan efficiency more than 1 percentage point as a result of the lower performance of the first-stage rotor. (The actual decrease in efficiency is not known because the peak efficiency of the small dampered fan configuration was not established at design speed.)

INTRODUCTION

The NASA Lewis Research Center is engaged in a comprehensive research program on fans and compressors. Because fan noise must be considered in the design of most advanced fans, an advanced, two-stage, high-pressure-ratio fan having widely spaced blade rows (for noise considerations) was built and tested (ref. 1). Even though the design-speed peak efficiency was not established for that fan, it was apparent that it would not meet its design efficiency and was somewhat low in weight flow. An attempt was made to improve performance by resetting the stators, and the fan was tested at 80 percent of design speed. The efficiency increase was on the order of 3 percentage points along with an increase of weight flow of 1.3 kilograms per second. However, before the effect of stator-blade reset could be evaluated at design speed, three vibration dampers failed.

Because of the performance improvement potential, the first-stage rotor was rebuilt to the same aerodynamic design, except for the inclusion of larger vibration dampers, and the fan was retested. This report presents the performance of the two-

stage, high-pressure-ratio fan with larger dampers on the first-stage rotor. Because the dampers significantly influenced performance, the results are compared with the original configuration (ref. 1). The data in this report are presented in both tabular and plotted form. The symbols and equations are defined in appendixes A and B. The definitions and units used for the tabular data are presented in appendix C.

TWO-STAGE FAN DESIGN

The aerodynamic and mechanical design of the two-stage fan is discussed in detail in reference 1. The flow path of the fan is shown in figure 1, and an assembly photograph of the two-stage fan is shown in figure 2. All significant blade design parameters are listed in tables I to III.

Part-span dampers on the first-stage rotor were located approximately 42 percent of span from the rotor tip to minimize blade vibrations. The meanline of the damper forms a conical surface that lies along the design streamline. Photographs and sketches of the original small damper and the redesigned large damper are presented in figure 3. The inner and outer surfaces of both dampers were formed by circular-arc sections passing through the leading and trailing edges, and the maximum thickness points for both dampers were located at midchord.

APPARATUS AND PROCEDURE

Compressor Test Facility

The two-stage fan was tested in the Lewis multistage compressor facility, which is described in reference 1. A schematic diagram of the facility is shown in figure 3. Atmospheric air enters the test facility at an inlet located on the roof of the building and flows through the flow measuring orifice, through the inlet butterfly throttle valves, and into the plenum chamber upstream of the test compressor. The air then passes through the test fan into the collector and is then exhausted either to the atmosphere or to an altitude exhaust system. Weight flow is controlled with a sleeve valve in the collector. For this series of tests the large inlet butterfly throttle valve remained fully open with the small valve fully closed, and the air was exhausted to the atmosphere.

Instrumentation

Radial surveys of the flow conditions were made at the fan inlet and behind the two stator-blade rows (see fig. 1). Total pressure, total temperature, and flow angle were measured with a combination probe (fig. 4). Each probe was positioned with a null-balancing, stream-direction-sensitive control system that automatically alined the probe to the direction of flow. The thermocouple material was iron-constantan. All pressures were measured with calibrated transducers. Two combination probes were used at the compressor inlet and behind the first-stage stator, and four combination probes were used behind the second-stage stator. The circumferential locations of the probes at each measuring station are shown in figure 5. The probes behind the stators were circumferentially traversed one stator-blade passage clockwise from the nominal values shown.

The fan weight flow was determined by means of a calibrated thin-plate orifice. An electronic speed counter, in conjunction with a magnetic pickup, was used to measure rotative speed (rpm).

The estimated errors in the data based on inherent accuracies of the instrumentation and recording system are as follows:

Weight flow, kg/sec	±0.3
Rotative speed, rpm	±30
Flow angle, deg	±1
Temperature, K	±0.6
Total pressure, N/cm^2, at -	
Station 1	±0.07
Station 2	±0.10
Station 3	±0.17

Test Procedure

The data were taken over a range of weight flows from maximum to near stall at equivalent rotative speeds of 80 and 100 percent of design speed. At each selected flow data were recorded at 11 radial positions at each of the 3 measuring stations. At each radial position the combination probes behind the stators (stations 2 and 3) were circumferentially traversed to 10 equally spaced locations across a stator-blade gap. Values of pressure, temperature, and flow angle were measured at each circumferential position. At the fan inlet (station 1) radial traverses were made to measure pressure, temperature, and flow angle at each radial position.

Calculation Procedure

At each radial position behind the two stator-blade rows, circumferential arrays of total pressure, total temperature, and flow angle were generated across a stator-blade gap by arithmetically averaging the measurements from the combination probes at each circumferential position.

At each radial position the arithmetically averaged values making up the circumferential arrays of total pressure, total temperature, and flow angle across one blade gap were again averaged as follows to obtain the representative values behind each stator-blade row. The total-pressure array was energy averaged; the total-temperature array was mass averaged; and the flow-angle array was arithmetically averaged. Those averaged values are presented herein.

Representative radial values of total pressure and total temperature between the rotor- and stator-blade rows (necessary for individual rotor and stator performance evaluation) were obtained from the arithmetically averaged circumferential arrays of total pressure and total temperature obtained downstream of the adjoining stator and translated upstream of the stator along design streamlines as follows: At each radial position total temperature was selected as the mass-averaged value of the arithmetically averaged values making up the circumferential array, and the highest value of total pressure was selected from the arithmetically averaged values making up the circumferential array.

Data were reduced using a computer program that calculates the radial distributions of static pressure at each measuring station and the radial distributions of flow angle at stations behind the rotors. Radial distributions of static pressure are calculated within the program from equations of continuity of mass flow and full radial equilibrium, which includes gradients of entropy and enthalpy and uses design streamline curvature, slope, and endwall blockage. Inputs to this program include equivalent weight flow, corrected speed, and radial distributions of total pressure and total temperature behind a rotor-blade row and equivalent weight flow along with radial distributions of total pressure, total temperature, and flow angle behind a stator-blade row.

To obtain overall performance for each rotor and stage, the radial values of total temperature were mass averaged, and the radial values of total pressure were energy averaged.

All data reported herein have been translated to the leading and trailing edges of each blade row by the method presented in reference 2. All pressures and temperatures were corrected to sea-level conditions based on the inlet conditions of the first-stage rotor. Weight flow and rotative speed were corrected to sea-level conditions based on the rotor-inlet conditions of each stage.

RESULTS AND DISCUSSION

The experimental results of the two-stage fan with large dampers on the first-stage rotor are presented in two sections: Overall Performance and Radial Distributions. The plotted data, along with additional parameters not shown in the figures, are also presented in tabular form (tables IV to IX). The definitions and units used in the tables appear in appendix C.

The experimental results from this two-stage fan are then compared with the experimental results from the same fan having small dampers on the first stage rotor and reported in reference 1.

Preliminary testing of the large-dampered configuration was conducted to determine the effect of stator reset on performance. Data were obtained at 80 and 100 percent of design speed over a wide combination of setting angles. The improvement in performance at 80 percent of design speed with the stators reset, was similar to that which was demonstrated with the small-dampered configuration. However, no improvement materialized with the large-dampered configuration at design speed. Optimum efficiency at design speed was obtained with design stator settings, and the data of this report are presented for that setting.

Overall Performance

Two-stage fan. - The overall performance of the two-stage fan at both 80 and 100 percent of design speed is presented in figure 7(a). Total-pressure ratio, total temperature ratio, and adiabatic efficiency are plotted as functions of equivalent weight flow. Several pertinent design-speed values follow:

	Stage peak efficiency performance	Design
Adiabatic efficiency	0.79	0.846
Weight flow, kg/sec	32.2	33.248
Total-pressure ratio	2.30	2.400
Total-temperature ratio	1.34	1.338

First stage. - The overall performance of the first stage and rotor are presented in figures 7(b) and (c). The design speed peak efficiency and several other peak efficiency values are given in the following table:

	Stage peak efficiency performance	Design
Stage		
Adiabatic efficiency	0.776	0.838
Weight flow, kg/sec	31.9	33.248
Total-pressure ratio	1.53	1.591
Rotor		
Adiabatic efficiency	0.81	0.886
Weight flow, kg/sec	31.9	33.248
Total-pressure ratio	1.56	1.632
Total-temperature ratio	1.168	1.169

Nondimensional stage performance. - Nondimensional performance of the first stage and rotor and the second stage and rotor are presented in figure 8, where head-rise coefficient, temperature-rise coefficient, and adiabatic efficiency are plotted as functions of stage flow coefficient. The spread in the data between the two speed lines (80 and 100 percent of design) is attributed to compressibility effects. The spread reveals the necessity that these effects be properly accounted for in any stage stacking technique used to predict off-design performance.

First stage:

	Stage peak efficiency performance	Design
Stage		
Adiabatic efficiency	0.776	0.838
Flow coefficient	0.43	0.453
Head-rise coefficient	0.215	0.226
Rotor		
Adiabatic efficiency	0.81	0.886
Flow coefficient	0.43	0.453
Head-rise coefficient	0.225	0.239
Temperature-rise coefficient	0.278	0.270

Second stage:

	Stage peak efficiency performance	Design
Stage		
Adiabatic efficiency	0.825	0.861
Flow coefficient	0.475	0.463
Head-rise coefficient	0.267	0.257
Rotor		
Adiabatic efficiency	0.865	0.902
Flow coefficient	0.475	0.463
Head-rise coefficient	0.283	0.268
Temperature-rise coefficient	0.325	0.298

Radial Distributions

The radial distributions of selected flow and performance parameters are shown for the first rotor and stator and for the second rotor and stator in figure 9. The results are presented for three fan weight flows at design speed. Design values are shown by the solid symbols. The performance results are compared to design values at a fan weight flow of 32.7 kilograms per second.

First stage. - The effect of the damper on rotor performance (fig. 9(a)) is evident at all three weight flows. Very low efficiencies are noted between 20 and 70 percent of blade span. The total-temperature ratio is significantly less than design over the outer 50 percent of the rotor blade. Total-pressure ratio is low over the outer 70 percent of blade span. The low pressure in the outer 20 percent of blade span is primarily attributed to the low energy addition. However, the low pressure ratio between 20 and 70 percent of span is attributed to both low energy addition and very high damper losses.

The stator blade (fig. 9(b)) operates at much lower-than-design incidence angles except locally in the damper and hub region. In the damper region of the rotor the combination of low meridional velocity and high deviation angles resulted in near-design incidence angle to the stator. In the hub region of the rotor the combination of high meridional velocity and low deviation angles also result in near-design incidence to the stator.

Second stage. - The radial gradients of flow and performance, attributed to the first-stage rotor damper are carried through the first stage and are influencing the

radial distributions of the second stage rotor (fig. 9(c)). Rather steep radial gradients of the second-stage rotor, particularly in the midsection of the blade behind the first-stage rotor damper, are noted in the radial distributions of total-pressure ratio, efficiency, incidence angle, meridional-velocity ratio, and loss. These induced gradients hamper the achievement of design matching of flow parameters, needed for good performance.

Rotor total-pressure ratio was equal to design values for the outer 30 percent of span, higher than design in the midspan region, and lower than design in the inner 30 percent of span. Total-temperature ratio was greater than design over the outer 40 percent of blade span. Efficiency is less than design at both the inner and outer 30 percent sections of blade span and higher in the midportion of the blade. Deviation angles are lower than design except at the hub and tip. Incidence angles were low in the inner 30 percent of span. Losses are high in the inner and outer 30 percents of span except locally at the hub.

The stator performance (fig. 9(d)) approached design values over most of the blade span. Local exceptions are noted particularly in the hub region where the stator is operating at very low off-design incidence angles and meridional velocity ratios with very high losses.

EFFECT OF DAMPER SIZE ON PERFORMANCE

Overall Performance

The overall performances of the two-stage fan with both large and small dampers are shown in figure 10. Averaged values of total-pressure ratio, total-temperature ratio, and adiabatic efficiency are plotted as functions of equivalent weight flow. The overall performances of the first rotor and stage are shown in figures 11(a) and (b) and of the second rotor and stage in figures 11(c) and (d). In figure 11 head-rise coefficient, temperature-rise coefficient, and adiabatic efficiency are plotted as functions of flow coefficient at design speed. The large-damper fan performance data are from figures 7 and 8, and small-damper fan performance from reference 1.

Two-stage fan. - As was noted in reference 1 and earlier in this report, this fan did not attain its design performance with either damper size (fig. 10). The small damper fan failed before the complete design speed performance at the low flow end of the design speed curve could be obtained. The highest measured efficiency for the small dampers was 0.795, and it still appeared to be increasing as flow decreased. The efficiency with large dampers peaked at 0.79. Maximum flow was 33.2 kilograms per second with small dampers and 32.8 kilograms per second with the large dampers.

First stage. - The first-stage rotor performance is presented in figure 11(a). Use of large dampers caused a further decrease in rotor performance. The large dampers increased the blockage, which apparently limited the maximum flow coefficient to 0.448 as compared with the 0.455 of the small dampers. High losses around the large dampers, as discussed in the section Radial Distributions, resulted in lower overall total-pressure ratio and, consequently, lower overall efficiencies. At a flow coefficient of approximately 0.45 rotor efficiency was 3-percentage-point lower with large dampers.

The performance of the first stage (fig. 11(b)) shows the same differences for the two rotor damper sizes, which fact indicates that the first-stage stator overall performance was not noticeably affected. At the flow coefficient of approximately 0.45, the stage, like the rotor, was 3 points lower in efficiency with the large dampers.

Second stage. - The overall performances of the second rotor and stage (figs. 11(c) and (d)) indicate that the damper size made no difference in the overall performance of the second stage.

Radial Distributions of Performance

The radial distributions of selected fan performance parameters for the two damper sizes are presented in figure 12. The plots are made at design speed and at fan equivalent weight flows of 32.7 kilograms per second for the large damper and 32.9 kilograms per second for the small damper.

First stage. - The differences in rotor performance for the two damper sizes are clearly evident in the damper region, where much higher losses were experienced with large dampers resulting in lower total-pressure ratio, and local losses in efficiency of up to 10 points (fig. 23). The meridional velocity behind the large-dampered rotor decreased because of the increased blockage, and the flow was redistributed through the outer 30 percent of the blade. The first-stage stator (fig. 12(b)) accepted this higher throughflow in the outer portion of the blade with no noticeable difference in performance, even though incidence angles decreased approximately 5° because of the higher flow.

Second stage. - Small differences in the second-stage rotor radial distributions of performance parameters (fig. 12(c)) occur in the midspan region of the blade. Here, the total-pressure ratio of the large damper configuration is higher, with locally higher efficiencies. In addition, incidence angles and meridional velocity ratio are higher and losses are lower. There are no appreciable differences in stator radial distributions (fig. 12(d)), with the exception of lower incidence and deviation angles noted in the inner 50 percent of the blade with the large damper configuration.

CONCLUDING REMARKS

For both the large and small dampered fan configurations, the reset stators produced increased weight flow, pressure ratio, and overall efficiency at 80 percent of design speed. At design speed, however, the small dampered configuration's performance with reset stators was not tested because of damper failure. The performance gains achieved at part speed with stator reset for the small dampered fan configuration was a factor in deciding to rebuild the rotor with larger dampers. At design speed the fan overall efficiency of the large dampered configuration tended to be insensitive to stator reset. To help understand why, an examination of the radial distributions of suction-surface incidence angles at design speed was made for both configurations and compared with those at 80 percent of design speed. (The data were compared at design stator blade settings.) At 80 percent of design speed the radial gradients of incidence angle were approximately the same for both configurations, and using stator reset to improve the matching resulted in similar improvements. At design speed, however, large radial gradients occurred in the damper region of the large dampered configuration. We suspect that the inability to optimize the stator incidence angles along the entire blade span must have a significant effect on the sensitivity of overall performance to stator reset. With the less-pronounced radial gradients in incidence angle for the small dampered configuration at design speed, this configuration would be more sensitive to stator reset.

SUMMARY OF RESULTS

A two-stage fan having part-span dampers on the first-stage rotor was tested and reported earlier. The dampers on the original rotor failed before completion of testing, and a new set of rotor blades were machined with dampers that were larger than those of the original. The aerodynamic design of the blade rows was not altered from the original. This report presents the overall performance and the radial distributions of performance parameters for the enlarged damper configuration and then compares the performance of the fan with the two damper sizes. The following principal results were obtained:

1. With the first-stage, large-dampered rotor, local losses in efficiency of up to 10 points were noted from that of the small damper. These high losses in the damper region reduced the rotor overall efficiency by 3 points.

2. The large dampered fan's two-stage efficiency was reduced at least 1 point, and its maximum weight flow was reduced by about 0.4 kilogram per second.

3. The overall performance of each blade row downstream of the damper was not significantly altered, even though the radial distributions of various performance parameters do show appreciable differences.

Lewis Research Center,
National Aeronautics and Space Administration,
Cleveland, Ohio, November 8, 1978,
505-04.

APPENDIX A

SYMBOLS

A_{an} annulus area at rotor leading edge, m^2

A_f frontal area at rotor leading edge, m^2

C_p specific heat at constant pressure, 1004 (J/kg) K

D diffusion factor

i_{mc} mean incidence angle, angle between inlet-air direction and line tangent to blade mean camber line at leading edge, deg

i_{ss} suction-surface incidence angle, angle between inlet-air direction and line tangent to blade suction surface at leading edge, deg

N rotative speed, rpm

P total pressure, N/cm^2

p static pressure, N/cm^2

r radius, cm

SM stall margin

T total temperature, K

U wheel speed, m/sec

V air velocity, m/sec

W weight flow, kg/sec

Z axial distance referenced from first-stage rotor-blade-hub leading edge, cm

α_c cone angle, deg

α_s slope of streamline, deg

β air angle, angle between air velocity and axial direction, deg

β'_c relative meridional air angle based on cone angle, arctan $(\tan \beta'_m \cos \alpha_c / \cos \alpha_s)$, deg

γ ratio of specific heats (1.40)

δ ratio of rotor-inlet total pressure to standard pressure of 10.13 N/cm^2

δ^o	deviation angle, angle between exit-air direction and tangent to blade mean camber line at trailing edge, deg
η	efficiency
θ	ratio of rotor-inlet total temperature to standard temperature of 288.2 K
κ_{mc}	angle between blade-element mean camber line on the conical surface and meridional plane, deg
κ_{ss}	angle between blade-element suction-surface leading edge tangent line on conical surface and meridional plane, deg
σ	solidity, ratio of chord to spacing
φ	flow coefficient
ψ_P	head-rise coefficient
ψ_T	temperature-rise coefficient
$\overline{\omega}$	total-loss coefficient
$\overline{\omega}_p$	profile-loss coefficient
$\overline{\omega}_s$	shock-loss coefficient

Subscripts:

ad	adiabatic (temperature rise)
id	ideal
LE	blade leading edge
m	meridional direction
mom	momentum rise
p	polytropic
TE	blade trailing edge
z	axial direction
θ	tangential direction
1	instrumentation plane upstream of first rotor
2	instrumentation plane between first stator and second rotor
3	instrumentation plane downstream of second stator

Superscript:

'	relative to blade

APPENDIX B

EQUATIONS FOR CALCULATING OVERALL AND BLADE-ELEMENT PERFORMANCE PARAMETERS

Suction-surface incidence angle -

$$i_{ss} = (\beta_c')_{LE} - \kappa_{ss} \tag{B1}$$

Mean incidence angle -

$$i_{mc} = (\beta_c')_{LE} - (\kappa_{mc})_{LE} \tag{B2}$$

Deviation angle -

$$\delta^o = (\beta_c')_{TE} - (\kappa_{mc})_{TE} \tag{B3}$$

Diffusion factor -

$$D = 1 - \frac{V_{TE}'}{V_{LE}'} + \left|\frac{(rV_\theta)_{TE} - (rV_\theta)_{LE}}{(r_{TE} + r_{LE})\sigma (V_{LE}')}\right| \tag{B4}$$

Total-loss coefficient -

$$\bar{\omega} = \frac{(P_{id}')_{TE} - P_{TE}'}{P_{LE}' - p_{LE}} \tag{B5}$$

Profile-loss coefficient -

$$\bar{\omega}_p = \bar{\omega} - \bar{\omega}_s \tag{B6}$$

Total-loss parameter -

$$\frac{\bar{\omega} \cos (\beta_m')_{TE}}{2\sigma} \tag{B7}$$

Profile-loss parameter -

$$\frac{\bar{\omega}_p \cos(\beta'_m)_{TE}}{2\sigma} \tag{B8}$$

Adiabatic (temperature rise) efficiency -

$$\eta_{ad} = \frac{\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1}{\frac{T_{TE}}{T_{LE}} - 1} \tag{B9}$$

Equivalent weight flow -

$$\frac{w\sqrt{\theta}}{\delta} \tag{B10}$$

Equivalent rotative speed -

$$\frac{N}{\sqrt{\theta}} \tag{B11}$$

Weight flow per unit annulus area -

$$\frac{\frac{w\sqrt{\theta}}{\delta}}{A_{an}} \tag{B12}$$

Weight flow per unit frontal area -

$$\frac{\frac{w\sqrt{\theta}}{\delta}}{A_f} \tag{B13}$$

Head-rise coefficient -

$$\psi_P = \frac{C_p T_{LE}}{U_{tip}^2}\left[\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1\right] \tag{B14}$$

Flow coefficient -

$$\varphi = \left(\frac{V_z}{U_{tip}}\right)_{LE} \tag{B15}$$

Temperature-rise coefficient -

$$\psi_P = \frac{C_p}{U_{tip}^2}(T_{TE} - T_{LE}) \tag{B16}$$

Polytropic efficiency -

$$\eta_p = \frac{\ln\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma}}{\ln\left(\frac{T_{TE}}{T_{LE}}\right)} \tag{B17}$$

APPENDIX C

DEFINITIONS AND UNITS USED IN TABLES

ABS	absolute
AERO CHORD	aerodynamic chord, cm
BETAM	meridional air angle, deg
CHOKE MARGIN	ratio of flow area greater than critical area to critical area
CONE ANGLE	angle between axial direction and conical surface representing blade element, deg
DELTA INC	difference between mean camber blade angle and suction-surface blade angle at leading edge, deg
DEV	deviation angle (defined by eq. (B3)), deg
D-FACT	diffusion factor (defined by eq. (B4))
EFF	adiabatic efficiency (defined by eq. (B9))
IN	inlet (leading edge of blade)
INCIDENCE	incidence angle (suction surface defined by eq. (B1) and mean by eq. (B2)), deg
KIC	angle between blade-element mean camber line on conical surface at leading edge and meridional plane, deg
KOC	angle between blade-element mean camber line on conical surface at trailing edge and meridional plane, deg
KTC	angle between blade-element mean camber line on conical surface at transition point and meridional plane, deg
LOSS COEFF	loss coefficient (total defined by eq. (B5) and profile by eq. (B6))
LOSS PARAM	loss parameter (total defined by eq. (B7) and profile by eq. (B8))
MERID	meridional
MERID VEL R	meridional velocity ratio
OUT	outlet (trailing edge of blade)
PERCENT SPAN	percent of blade span from tip referenced to first-stage-rotor outlet
PHISS	suction-surface camber ahead of assumed shock location, deg
PRESS	pressure, N/cm^2

PROF	profile
RADII	radius, cm
REL	relative to blade
RI	inlet radius (leading edge of blade), cm
RO	outlet radius (trailing edge of blade), cm
RP	radial position
RPM	equivalent rotative speed, rpm
SETTING ANGLE	angle between blade-element aerodynamic chord on conical surface and meridional plane, deg
SOLIDITY	ratio of aerodynamic chord to blade spacing
SPEED	speed, m/sec
SS	suction surface
STREAMLINE SLOPE	slope of streamline, deg
TANG	tangential
TEMP	temperature, K
TI	thickness of blade at leading edge, cm
TM	thickness of blade at maximum thickness, cm
TO	thickness of blade at trailing edge, cm
TOT	total
TOTAL CAMBER	difference between inlet and outlet blade-element angles on mean camber lines, deg (KIC-KOC)
TURNING RATIO	ratio of mean camber line curvatures upstream and downstream of transition point
VEL	velocity, m/sec
WT FLOW	equivalent weight flow, kg/sec
ZI	axial distance to blade leading edge, cm
ZMC	axial distance to blade maximum thickness point, cm
ZO	axial distance to blade trailing edge, cm
ZTC	axial distance to transition point, cm

REFERENCES

1. Cunnan, Walter S.; Stevans, William; and Urasek, Donald C.: Design and Performance of a 427-Meter-per-Second Tip Speed Two-Stage Fan Having a 2.40 Pressure Ratio. NASA TP-1344, 1978.

2. Ball, Calvin L.; Janetzke, David C.; and Reid, Lonnie: Performance of 1380 Foot-Per-Second-Tip-Speed Axial-Flow Compressor Rotor with Blade Tip Solidity of 1.5. NASA TM X-2379, 1972.

TABLE I. - DESIGN OVERALL FAN PERFORMANCE

(a) Two-stage fan

TOTAL PRESSURE RATIO	2.400
TOTAL TEMPERATURE RATIO	1.335
ADIABATIC EFFICIENCY	0.846
POLYTROPIC EFFICIENCY	0.863
RPM (BASED ON FAN INLET)	16042.8
WT FLOW	33.248

(b) First stage

ROTOR TOTAL PRESSURE RATIO	1.632
STAGE TOTAL PRESSURE RATIO	1.591
ROTOR TOTAL TEMPERATURE RATIO	1.169
STAGE TOTAL TEMPERATURE RATIO	1.169
ROTOR ADIABATIC EFFICIENCY	0.886
STAGE ADIABATIC EFFICIENCY	0.838
ROTOR POLYTROPIC EFFICIENCY	0.894
STAGE POLYTROPIC EFFICIENCY	0.848
ROTOR HEAD RISE COEFFICIENT	0.239
STAGE HEAD RISE COEFFICIENT	0.226
FLOW COEFFICIENT	0.453
WT FLOW PER UNIT FRONTAL AREA	164.041
WT FLOW PER UNIT ANNULUS AREA	195.287
TIP SPEED	426.720

(c) Second stage

ROTOR TOTAL PRESSURE RATIO	1.537
STAGE TOTAL PRESSURE RATIO	1.508
ROTOR TOTAL TEMPERATURE RATIO	1.144
STAGE TOTAL TEMPERATURE RATIO	1.144
ROTOR ADIABATIC EFFICIENCY	0.902
STAGE ADIABATIC EFFICIENCY	0.861
ROTOR POLYTROPIC EFFICIENCY	0.908
STAGE POLYTROPIC EFFICIENCY	0.868
ROTOR HEAD RISE COEFFICIENT	0.269
STAGE HEAD RISE COEFFICIENT	0.257
FLOW COEFFICIENT	0.463
WT FLOW PER UNIT FRONTAL AREA	181.801
WT FLOW PER UNIT ANNULUS AREA	260.974
TIP SPEED	405.341

EQUIVALENT VALUES BASED ON STAGE INLET

WT FLOW PER UNIT FRONTAL AREA	123.489
WT FLOW PER UNIT ANNULUS AREA	177.268
WT FLOW	22.584
RPM	14835.823
TIP SPEED	374.845

TABLE II. - DESIGN BLADE-ELEMENT PARAMETERS

(a) First-stage rotor

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
TIP	25.400	24.938	.0	41.7	68.5	62.1	288.2	1.194	10.14	1.632
1	24.704	24.266	.0	41.8	66.9	61.2	288.2	1.189	10.14	1.532
2	23.977	23.594	.0	41.8	65.4	60.1	288.2	1.185	10.14	1.632
3	22.538	22.250	.0	41.8	63.0	57.1	288.2	1.177	10.14	1.632
4	21.091	20.907	.0	42.1	60.7	53.7	288.2	1.170	10.14	1.632
5	20.219	20.101	.0	42.5	59.4	51.1	288.2	1.167	10.14	1.632
6	19.343	19.294	.0	43.2	58.1	48.2	288.2	1.166	10.14	1.632
7	18.167	18.219	.0	44.3	56.4	43.5	288.2	1.164	10.14	1.632
9	15.134	15.532	.0	46.9	51.9	26.5	288.2	1.160	10.14	1.632
9	13.534	14.188	.0	48.7	49.3	14.5	238.2	1.160	10.14	1.632
10	11.853	12.845	.0	50.2	46.5	.5	288.2	1.160	10.14	1.632
11	10.973	12.[illegible]73	.0	50.7	44.9	-6.4	288.2	1.159	10.14	1.632
HUB	10.160	11.501	.0	51.1	43.3	-12.8	288.2	1.158	10.14	1.632

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
TIP	168.0	201.7	458.6	322.0	168.0	150.5	.0	134.3	426.7	419.0
1	177.1	201.5	451.3	311.8	177.1	150.2	.0	134.4	415.0	407.7
2	184.5	202.1	443.1	301.8	184.5	15[illegible].5	.0	134.8	402.6	396.4
3	192.9	205.3	424.9	282.0	192.9	15[illegible].0	.0	136.9	378.6	373.8
4	198.6	209.2	406.2	261.9	198.6	155.2	.0	140.3	354.3	351.2
5	200.8	212.3	394.6	249.4	200.8	156.5	.0	143.5	339.7	337.7
6	202.1	216.2	382.7	236.2	202.1	157.5	.0	148.1	325.0	324.1
7	202.8	222.2	366.5	219.4	202.8	159.[illegible]	.0	155.1	305.2	306.1
8	199.5	243.5	323.2	185.8	199.5	166.[illegible]	.0	177.9	254.3	260.9
9	195.3	258.8	299.7	176.5	195.3	170.[illegible]	.0	194.3	227.4	238.4
10	189.1	278.9	274.6	178.4	189.1	178.4	.0	214.4	199.1	215.8
11	185.0	291.1	261.2	185.5	185.0	184.3	.0	225.3	184.4	204.5
HUB	181.3	303.8	249.0	195.6	181.3	190.8	.0	236.4	170.7	193.2

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	STREAMLINE SLOPE IN	STREAMLINE SLOPE OUT	MERID VEL R	PEAK SS MACH NO
TIP	.506	.559	1.382	.893	.506	.417	-11.06	-12.78	.896	1.505
1	.535	.560	1.364	.866	.535	.417	-9.47	-10.60	.848	1.473
2	.559	.563	1.342	.840	.559	.419	-8.01	-8.73	.816	1.445
3	.586	.574	1.291	.789	.586	.428	-5.71	-5.93	.793	1.402
4	.605	.588	1.237	.736	.605	.436	-3.49	-3.45	.782	1.372
5	.612	.598	1.202	.702	.612	.441	-2.17	-2.09	.779	1.356
6	.616	.610	1.167	666	.616	.444	-.86	-.79	.779	1.344
7	.619	.629	1.117	.621	.619	.450	.90	.87	.785	1.333
8	.608	.696	.984	.531	.608	.475	5.82	5.00	.833	1.344
9	.594	.744	.912	.508	.594	.491	8.91	7.17	.875	1.295
10	.574	.810	.833	.518	.574	.518	12.90	9.50	.944	1.225
11	.561	.850	.791	.542	.561	.538	15.41	10.77	.996	1.176
HUB	.549	.893	.753	.575	.549	.561	17.84	12.07	1.052	1.129

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
TIP	.00	2.1	.0	2.8	.410	.773	.177	.098	.032	.018
1	5.00	2.3	.0	2.8	.420	.794	.160	.091	.029	.016
2	10.00	2.5	.0	2.9	.429	.814	.145	.084	.026	.015
3	20.00	3.0	-.0	3.1	.447	.849	.119	.073	.022	.014
4	30.00	3.4	-.0	3.4	.467	.882	.096	.061	.018	.012
5	36.00	3.6	-.0	3.7	.481	.897	.086	.056	.017	.011
6	42.00	3.9	-.0	4.0	.498	.905	.081	.057	.016	.011
7	50.00	4.2	-.0	4.5	.520	.916	.076	.058	.015	.012
8	70.00	4.9	.0	6.6	.557	.936	.067	.058	.014	.012
9	80.00	5.0	.0	7.9	.552	.939	.072	.070	.015	.014
10	90.00	4.8	.0	9.1	.502	.940	.081	.081	.015	.015
11	95.00	4.6	.0	10.0	.447	.944	.083	.083	.014	.014
HUB	100.00	4.3	.0	11.6	.376	.948	.082	.082	.013	.013

TABLE II. - Continued. DESIGN BLADE-ELEMENT PARAMETERS

(b) First-stage stator

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
TIP	24.384	24.384	38.5	.0	38.5	.0	344.2	1.000	16.54	.979
1	23.758	23.76[illegible]	38.2	.0	38.2	.0	342.7	1.000	16.54	.980
2	23.167	23.200	37.9	.0	37.9	.0	341.3	1.000	16.54	.981
3	21.981	22.068	37.9	.0	37.9	.0	339.1	1.000	16.54	.982
4	20.787	20.927	38.1	.0	38.1	.0	337.2	1.000	16.54	.982
5	20.070	20.243	38.5	.0	38.5	.0	336.4	1.000	16.54	.982
6	19.350	19.558	39.2	.0	39.2	.0	335.9	1.000	16.54	.982
7	18.388	18.650	40.3	.0	40.3	.0	335.4	1.000	16.54	.980
8	15.962	16.388	43.6	.0	43.6	.0	334.4	1.000	16.54	.972
9	14.733	15.263	45.9	.0	45.9	.0	334.2	1.000	16.54	.964
10	13.493	14.144	48.7	.0	48.7	.0	334.2	1.000	16.54	.950
11	12.868	13.586	50.1	.0	50.1	.0	334.0	1.000	16.54	.940
HUB	12.189	12.931	51.7	.0	51.7	.0	333.8	1.000	16.54	.928

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
TIP	221.0	174.2	221.0	174.2	173.0	174.2	137.6	.0	.0	.0
1	222.1	174.2	222.1	174.2	174.7	174.2	137.2	.0	.0	.0
2	223.3	174.3	223.3	174.3	176.1	174.3	137.3	.0	.0	.0
3	225.8	174.7	225.8	174.7	178.3	174.7	138.6	.0	.0	.0
4	228.7	175.2	228.7	175.2	180.0	175.2	141.1	.0	.0	.0
5	230.9	175.5	230.9	175.5	180.7	175.5	143.7	.0	.0	.0
6	233.6	175.6	233.6	175.6	181.0	175.6	147.7	.0	.0	.0
7	237.7	175.3	237.7	175.3	181.4	175.3	153.7	.0	.0	.0
8	251.2	173.4	251.2	173.4	182.0	173.4	173.1	.0	.0	.0
9	260.6	170.8	260.6	170.8	181.3	170.8	187.1	.0	.0	.0
10	271.7	166.8	271.7	166.8	179.5	166.8	204.0	.0	.0	.0
11	277.6	164.6	277.6	164.6	178.0	164.6	213.0	.0	.0	.0
HUB	284.2	162.0	284.2	162.0	176.2	162.0	223.0	.0	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	STREAMLINE SLOPE IN	STREAMLINE SLOPE OUT	MERID VEL R	PEAK SS MACH NO
TIP	.616	.479	.616	.479	.482	.479	-1.22	.46	1.007	.839
1	.621	.480	.621	.480	.489	.480	-.81	.50	.997	.822
2	.626	.481	.626	.481	.494	.481	-.45	.59	.990	.811
3	.636	.484	.636	.484	.502	.484	.21	.90	.980	.803
4	.647	.487	.647	.487	.509	.487	.93	1.33	.973	.805
5	.654	.489	.654	.489	.512	.489	1.38	1.65	.971	.811
6	.663	.489	.663	.489	.514	.489	1.85	2.01	.970	.824
7	.677	.489	.677	.489	.516	.489	2.51	2.50	.966	.843
8	.720	.484	.720	.484	.522	.484	4.34	3.75	.953	.910
9	.750	.477	.750	.477	.522	.477	5.37	4.25	.942	.961
10	.786	.465	.786	.465	.519	.465	6.43	4.42	.929	1.027
11	.805	.459	.805	.459	.516	.459	6.97	4.30	.925	1.064
HUB	.828	.451	.828	.451	.513	.451	7.54	4.13	.919	1.106

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
TIP	.00	3.0	-3.0	17.0	.457	.000	.094	.094	.037	.037
1	5.00	3.0	-3.0	13.9	.453	.000	.086	.086	.033	.033
2	10.00	3.0	-3.0	11.9	.449	.000	.082	.082	.031	.031
3	20.00	2.9	-3.0	10.0	.444	.000	.077	.077	.027	.027
4	30.00	2.8	-3.0	9.3	.441	.000	.073	.073	.025	.025
5	36.00	2.8	-3.0	9.0	.442	.000	.072	.072	.023	.023
6	42.00	2.7	-3.0	8.8	.446	.000	.072	.072	.023	.023
7	50.00	2.7	-3.0	8.6	.454	.000	.077	.077	.023	.023
8	70.00	2.5	-3.0	9.0	.486	.000	.095	.095	.025	.025
9	80.00	2.3	-3.0	9.7	.514	.000	.115	.115	.028	.028
10	90.00	2.2	-3.0	11.7	.549	.000	.150	.150	.033	.033
11	95.00	2.0	-3.0	13.2	.565	.000	.173	.173	.037	.037
HUB	100.00	1.9	-3.0	15.0	.583	.000	.198	.198	.040	.040

TABLE II. - Continued. DESIGN BLADE-ELEMENT PARAMETERS

(c) Second-stage rotor

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
TIP	24.127	23.719	.0	39.2	65.5	57.3	344.3	1.157	16.20	1.530
1	23.533	23.187	.0	39.5	64.4	56.8	342.7	1.154	16.21	1.529
2	23.002	22.707	.0	39.8	63.5	56.2	341.3	1.151	16.22	1.528
3	21.951	21.741	.0	40.0	62.1	54.3	339.1	1.147	16.24	1.527
4	20.900	20.779	.0	40.3	60.7	52.1	337.2	1.143	16.24	1.526
5	20.272	20.206	.0	40.7	60.0	50.5	336.4	1.141	16.24	1.527
6	19.646	19.636	.0	41.3	59.2	48.6	335.9	1.140	16.23	1.527
7	18.813	18.888	.0	42.1	58.3	45.7	335.4	1.139	16.20	1.530
8	16.721	17.072	.0	44.6	56.5	36.4	334.4	1.140	16.08	1.542
9	15.652	16.198	.0	46.6	56.1	30.0	334.2	1.142	15.94	1.555
10	14.537	15.351	.0	49.3	56.7	21.6	334.2	1.147	15.71	1.578
11	13.951	14.938	.0	50.7	57.7	16.5	334.0	1.150	15.55	1.594
HUB	13.289	14.455	.0	52.4	59.2	10.1	333.8	1.154	15.36	1.614

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
TIP	185.0	216.9	445.6	310.7	185.0	168.0	.0	137.1	405.3	398.5
1	189.4	214.6	438.4	302.3	189.4	165.5	.0	136.6	395.3	309.5
2	192.3	213.4	431.7	294.9	192.3	164.0	.0	136.4	386.4	381.5
3	195.2	213.5	417.3	280.5	195.2	163.5	.0	137.3	368.8	365.3
4	196.7	214.6	402.5	266.3	196.7	163.6	.0	138.9	351.1	349.1
5	197.0	216.1	393.4	257.4	197.0	163.8	.0	140.9	340.6	339.5
6	196.6	218.2	384.2	247.9	196.6	164.0	.0	144.0	330.1	329.9
7	195.2	221.6	371.4	235.6	195.2	164.4	.0	148.6	316.1	317.3
8	186.0	233.8	336.9	206.9	186.0	166.6	.0	164.1	280.9	286.8
9	176.6	242.3	316.7	192.2	176.6	166.4	.0	176.0	262.9	272.1
10	160.2	253.7	292.1	178.0	160.2	165.5	.0	192.4	244.2	257.9
11	147.9	260.9	277.2	172.2	147.9	165.1	.0	202.0	234.4	251.0
HUB	133.2	269.7	260.0	167.3	133.2	164.8	.0	213.6	223.3	242.8

	ABS MACH NO		REL MACH NO		MERID MACH NO		STREAMLINE SLOPE		MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
TIP	.511	.559	1.230	.801	.511	.433	-8.36	-6.25	.908	1.414
1	.525	.555	1.214	.782	.525	.428	-6.98	-5.15	.874	1.386
2	.534	.554	1.199	.765	.534	.426	-5.85	-4.24	.853	1.366
3	.545	.557	1.164	.732	.545	.427	-3.92	-2.71	.837	1.343
4	.551	.563	1.127	.699	.551	.429	-2.14	-1.24	.832	1.324
5	.552	.568	1.103	.677	.552	.431	-1.12	-.38	.832	1.314
6	.552	.575	1.078	.653	.552	.432	-.11	.47	.834	1.304
7	.548	.585	1.042	.622	.548	.434	1.22	1.62	.843	1.298
8	.521	.620	.944	.549	.521	.442	4.72	4.68	.896	1.260
9	.494	.644	.886	.511	.494	.443	6.62	6.36	.943	1.222
10	.446	.676	.813	.474	.446	.441	8.58	8.20	1.033	1.184
11	.411	.696	.770	.459	.411	.440	9.57	9.21	1.116	1.165
HUB	.369	.721	.720	.447	.369	.440	10.69	10.40	1.237	1.143

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
TIP	.00	2.5	-.0	2.4	.421	.819	.136	.095	.028	.020
1	5.00	2.5	-.0	2.5	.427	.835	.124	.089	.026	.019
2	10.00	2.5	-.0	2.6	.433	.849	.114	.084	.024	.017
3	20.00	2.7	-.0	3.0	.444	.873	.097	.074	.020	.015
4	30.00	3.1	-.0	3.4	.455	.897	.081	.063	.017	.013
5	36.00	3.4	-.0	3.7	.463	.907	.074	.059	.016	.012
6	42.00	3.7	-.0	4.0	.474	.913	.071	.059	.015	.012
7	50.00	4.2	-.0	4.6	.488	.923	.066	.057	.014	.012
8	70.00	5.2	-.0	6.4	.520	.939	.060	.058	.013	.013
9	80.00	5.4	-.0	7.8	.539	.942	.065	.064	.014	.014
10	90.00	5.2	-.0	9.9	.553	.942	.076	.076	.017	.017
11	95.00	4.9	-.0	11.3	.553	.944	.082	.082	.018	.018
HUB	100.00	4.7	.1	12.8	.545	.945	.091	.091	.020	.020

TABLE II. - Concluded. DESIGN BLADE-ELEMENT PARAMETERS

(d) Second-stage stator

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
TIP	23.622	23.622	39.2	.0	39.2	.0	398.4	1.000	24.79	.983
1	23.108	23.129	38.8	.0	38.8	.0	395.4	1.000	24.79	.984
2	22.646	22.686	38.5	.0	38.5	.0	392.9	1.000	24.79	.984
3	21.728	21.802	38.2	.0	38.2	.0	388.8	1.000	24.79	.985
4	20.924	20.923	38.1	.0	38.1	.0	385.3	1.000	24.79	.986
5	20.287	20.400	38.3	.0	38.3	.0	383.8	1.000	24.79	.985
6	19.757	19.884	38.8	.0	38.8	.0	383.0	1.000	24.79	.985
7	19.060	19.204	39.5	.0	39.5	.0	382.2	1.000	24.79	.984
8	17.367	17.566	42.1	.0	42.1	.0	381.0	1.000	24.79	.979
9	16.547	16.786	44.5	.0	44.5	.0	381.7	1.000	24.79	.975
10	15.739	16.040	48.0	.0	48.0	.0	383.3	1.000	24.79	.967
11	15.338	15.682	50.3	.0	50.3	.0	384.2	1.000	24.79	.963
HUB	14.869	15.237	52.9	.0	52.9	.0	385.3	1.000	24.79	.958

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
TIP	217.8	170.2	217.8	170.2	168.0	170.2	137.7	.0	.0	.0
1	218.8	170.3	218.8	170.3	170.6	170.3	137.0	.0	.0	.0
2	219.8	170.3	219.8	170.3	172.0	170.3	136.8	.0	.0	.0
3	222.1	170.3	222.1	170.3	174.5	170.3	137.4	.0	.0	.0
4	224.5	170.3	224.5	170.3	176.6	170.3	138.6	.0	.0	.0
5	226.3	170.3	226.3	170.3	177.5	170.3	140.4	.0	.0	.0
6	228.4	170.3	228.4	170.3	178.0	170.3	143.1	.0	.0	.0
7	231.4	170.1	231.4	170.1	178.5	170.1	147.3	.0	.0	.0
8	240.3	169.5	240.3	169.5	178.2	169.5	161.3	.0	.0	.0
9	245.9	168.5	245.9	168.5	175.5	168.5	172.3	.0	.0	.0
10	252.3	167.5	252.3	167.5	168.8	167.5	187.6	.0	.0	.0
11	255.7	167.5	255.7	167.5	163.4	167.5	196.7	.0	.0	.0
HUB	260.2	167.4	260 2	167.4	156.8	167.4	207.7	.0	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	STREAMLINE SLOPE IN	STREAMLINE SLOPE OUT	MERID VEL R	PEAK SS MACH NO
TIP	.562	.434	.562	.434	.435	.434	-.10	-.03	1.008	.787
1	.567	.435	.567	.435	.442	.435	.19	.18	.998	.775
2	.571	.437	.571	.437	.447	.437	.44	.35	.990	.767
3	.581	.439	.581	.439	.457	.439	.88	.65	.975	.759
4	.591	.441	.591	.441	.465	.441	1.32	.90	.964	.758
5	.597	.442	.597	.442	.468	.442	1.58	1.01	.959	.763
6	.603	.443	.603	.443	.470	.443	1.86	1.11	.956	.773
7	.613	.443	.613	.443	.473	.443	2.23	1.24	.953	.787
8	.639	.442	.639	.442	.474	.442	3.23	1.45	.951	.838
9	.655	.439	.655	.439	.467	.439	3.81	1.53	.960	.884
10	.672	.435	.672	.435	.447	.435	4.55	1.55	.993	.954
11	.681	.435	.681	.435	.435	.435	5.01	1.52	1.025	.999
HUB	.693	.434	.693	.434	.417	.434	5.57	1.49	1.068	1.056

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
TIP	.00	2.8	-3.0	16.2	.471	.000	.086	.086	.034	.034
1	5.00	2.7	-3.0	14.0	.466	.000	.083	.083	.032	.032
2	10.00	2.7	-3.0	12.4	.463	.000	.080	.080	.031	.031
3	20.00	2.7	-3.0	10.4	.461	.000	.073	.073	.027	.027
4	30.00	2.6	-3.0	9.5	.459	.000	.069	.069	.024	.024
5	36.00	2.6	-3.0	9.3	.460	.000	.068	.068	.023	.023
6	42.00	2.6	-3.0	9.2	.464	.000	.069	.069	.023	.023
7	50.00	2.5	-3.0	9.1	.470	.000	.072	.072	.023	.023
8	70.00	2.3	-3.0	9.5	.492	.000	.086	.086	.025	.025
9	80.00	2.3	-3.0	10.5	.511	.000	.102	.102	.029	.029
10	90.00	2.1	-3.0	12.8	.533	.000	.125	.125	.034	.034
11	95.00	2.1	-3.0	14.7	.544	.000	.138	.138	.036	.036
HUB	100.00	1.9	-3.0	17.2	.557	.000	.156	.156	.039	.039

TABLE III. - BLADE GEOMETRY

(a) First-stage rotor

RP	PERCENT SPAN	RADII RI	RADII RO	BLADE ANGLES KIC	BLADE ANGLES KTC	BLADE ANGLES KOC	DELTA INC	CONE ANGLE
TIP	0.	25.400	24.938	66.34	63.45	59.36	2.04	-12.624
1	5.	24.704	24.266	64.50	61.99	58.37	2.23	-11.279
2	10.	23.977	23.594	62.80	60.43	57.16	2.46	-9.342
3	20.	22.538	22.250	60.02	57.21	54.03	3.01	-6.371
4	30.	21.091	20.907	57.33	53.66	50.21	3.40	-3.741
5	36.	20.219	20.101	55.77	51.46	47.46	3.64	-2.288
6	42.	19.343	19.294	54.23	49.15	44.18	3.89	-.891
7	50.	18.167	18.219	52.18	45.94	39.01	4.21	.898
8	70.	15.134	15.532	46.99	36.89	19.96	4.88	5.684
9	80.	13.534	14.188	44.35	31.92	6.51	4.98	8.621
10	90.	11.853	12.845	41.73	27.08	-8.65	4.78	12.240
11	95.	10.973	12.173	40.46	24.92	-16.35	4.53	14.460
HUB	100.	10.160	11.501	39.30	23.02	-24.12	4.27	15.866

RP	BLADE THICKNESSES TI	BLADE THICKNESSES TM	BLADE THICKNESSES TO	AXIAL DIMENSIONS ZI	AXIAL DIMENSIONS ZMC	AXIAL DIMENSIONS ZTC	AXIAL DIMENSIONS ZO
TIP	.047	.136	.047	1.337	2.318	2.722	3.401
1	.052	.148	.051	1.268	2.320	2.688	3.466
2	.056	.161	.056	1.202	2.322	2.647	3.531
3	.065	.187	.066	1.088	2.324	2.544	3.659
4	.074	.212	.076	.973	2.325	2.412	3.795
5	.079	.228	.081	.903	2.325	2.319	3.879
6	.085	.244	.087	.832	2.324	2.215	3.969
7	.093	.265	.095	.732	2.320	2.057	4.094
8	.113	.320	.115	.439	2.290	1.555	4.437
9	.124	.350	.126	.273	2.287	1.254	4.589
10	.136	.385	.137	.117	2.285	.952	4.687
11	.143	.405	.143	.054	2.293	.816	4.706
HUB	.149	.423	.150	.000	2.301	.696	4.719

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	TURNING RATIO	PHISS	CHOKE MARGIN
TIP	4.739	63.84	6.97	1.288	.298	3.56	.040
1	4.752	62.23	6.13	1.328	.338	3.13	.040
2	4.750	60.60	5.64	1.367	.403	2.92	.040
3	4.743	57.38	[illegible]	1.450	.621	3.16	.040
4	4.739	53.84	7.12	1.544	.935	3.72	.040
5	4.737	51.54	8.31	1.608	1.089	4.13	.040
6	4.736	49.01	10.05	1.678	1.178	4.63	.040
7	4.736	45.26	13.17	1.782	1.251	5.39	.040
8	4.748	32.63	27.03	2.119	1.356	7.99	.040
9	4.770	24.11	37.84	2.355	1.467	9.56	.040
10	4.826	14.51	50.38	2.674	1.660	10.99	.040
11	4.871	9.66	56.81	2.881	1.786	11.47	.040
HUB	4.923	4.85	63.42	3.111	1.909	11.85	.040

TABLE III. - Continued. BLADE GEOMETRY

(b) First-stage stator

RP	PERCENT SPAN	RADII RI	RADII RO	BLADE ANGLES KIC	BLADE ANGLES KTC	BLADE ANGLES KOC	DELTA INC	CONE ANGLE
TIP	0.	24.384	24.384	35.53	18.39	-16.99	5.96	.057
1	5.	23.758	23.761	35.19	19.29	-13.93	5.96	.057
2	10.	23.167	23.200	34.98	20.01	-11.87	5.96	.331
3	20.	21.981	22.068	34.96	21.01	-10.04	5.91	.884
4	30.	20.787	20.927	35.24	21.89	-9.30	5.84	1.434
5	36.	20.070	20.243	35.69	22.52	-8.97	5.80	1.778
6	42.	19.350	19.558	36.45	23.26	-8.80	5.75	2.141
7	50.	18.388	18.650	37.60	24.34	-8.62	5.67	2.702
8	70.	15.962	16.388	41.11	27.43	-8.96	5.45	4.427
9	80.	14.733	15.263	43.56	29.39	-9.73	5.32	5.527
10	90.	13.493	14.144	46.49	31.56	-11.65	5.14	6.797
11	95.	12.868	13.506	48.04	32.67	-13.16	5.03	7.501
HUB	100.	12.189	12.931	49.76	33.90	-15.03	4.89	7.754

RP	BLADE THICKNESSES TI	BLADE THICKNESSES TM	BLADE THICKNESSES TO	AXIAL DIMENSIONS ZI	AXIAL DIMENSIONS ZMC	AXIAL DIMENSIONS ZTC	AXIAL DIMENSIONS ZO
TIP	.150	.460	.150	10.457	13.179	12.211	16.112
1	.146	.454	.146	10.474	13.178	12.198	16.106
2	.141	.448	.141	10.486	13.177	12.181	16.101
3	.131	.436	.131	10.497	13.175	12.131	16.094
4	.122	.425	.121	10.507	13.176	12.079	16.092
5	.117	.418	.115	10.515	13.175	12.054	16.091
6	.111	.411	.110	10.524	13.172	12.034	16.089
7	.103	.402	.102	10.541	13.171	12.011	16.089
8	.085	.379	.084	10.584	13.161	11.938	16.087
9	.075	.367	.074	10.613	13.156	11.899	16.088
10	.066	.355	.065	10.639	13.146	11.846	16.094
11	.061	.350	.060	10.647	13.140	11.810	16.098
HUB	.055	.344	.055	10.656	13.132	11.768	16.103

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	TURNING RATIO	PHISS	CHOKE MARGIN
TIP	5.729	9.29	52.52	1.271	1.000	10.86	.224
1	5.728	10.63	49.12	1.305	1.000	9.79	.210
2	5.729	11.56	46.85	1.337	1.000	9.02	.199
3	5.729	12.47	45.00	1.408	1.000	8.17	.182
4	5.730	12.99	44.55	1.487	1.000	7.69	.168
5	5.731	13.39	44.66	1.539	1.000	7.57	.161
6	5.732	13.86	45.25	1.594	1.000	7.64	.154
7	5.734	14.54	46.22	1.676	1.000	7.74	.145
8	5.743	16.18	50.07	1.921	1.000	8.19	.121
9	5.751	17.07	53.29	2.075	1.000	8.64	.112
10	5.762	17.65	58.14	2.256	1.000	9.33	.106
11	5.769	17.73	61.20	2.360	1.000	9.72	.106
HUB	5.768	17.70	64.79	2.485	1.000	10.16	.106

TABLE III. - Continued. BLADE GEOMETRY

(c) Second-stage rotor

RP	PERCENT SPAN	RADII RI	RO	BLADE ANGLES KIC	KTC	KOC	DELTA INC	CONE ANGLE
TIP	0.	24.127	23.719	62.90	58.37	54.69	2.57	-8.911
1	5.	23.533	23.187	61.90	57.70	54.18	2.50	-7.354
2	10.	23.002	22.707	61.04	56.96	53.48	2.50	-6.131
3	20.	21.951	21.741	59.42	55.00	51.31	2.69	-4.123
4	30.	20.900	20.779	57.67	52.82	48.70	3.07	-2.246
5	36.	20.272	20.206	56.59	51.42	46.79	3.37	-1.186
6	42.	19.646	19.636	55.52	50.00	44.57	3.70	-.183
7	50.	18.813	18.888	54.14	48.02	41.14	4.17	1.246
8	70.	16.721	17.072	51.30	42.93	29.92	5.19	5.162
9	80.	15.657	16.198	50.65	40.51	22.09	5.41	7.585
10	90.	14.5[illegible]	15.351	51.37	38.55	11.58	5.23	10.660
11	95.	13.951	14.938	52.58	37.90	5.04	4.95	12.566
HUB	100.	13.289	14.455	54.11	37.26	-2.85	4.58	14.381

RP	BLADE THICKNESSES TI	TM	TO	AXIAL DIMENSIONS ZI	ZMC	ZTC	ZO
TIP	.060	.173	.060	22.053	23.285	23.731	24.661
1	.065	.175	.066	22.019	23.291	23.694	24.699
2	.070	.179	.071	21.987	23.295	23.657	24.737
3	.079	.196	.080	21.917	23.300	23.571	24.826
4	.089	.222	.090	21.836	23.299	23.462	24.919
5	.094	.241	.096	21.786	23.299	23.390	24.980
6	.100	.261	.102	21.736	23.299	23.312	25.044
7	.107	.289	.110	21.667	23.296	23.199	25.134
8	.126	.357	.129	21.486	23.280	22.878	25.374
9	.135	.385	.138	21.393	23.264	22.702	25.500
10	.146	.406	.147	21.299	23.239	22.517	25.623
11	.152	.413	.153	21.251	23.220	22.421	25.679
HUB	.159	.419	.159	21.197	23.196	22.312	25.744

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	TURNING RATIO	PHISS	CHOKE MARGIN
TIP	5.111	59.28	8.21	1.292	.599	5.12	.040
1	5.105	58.46	7.72	1.322	.631	4.68	.040
2	5.103	57.62	7.56	1.350	.676	4.48	.040
3	5.099	55.57	8.11	1.412	.814	4.68	.040
4	5.096	53.25	8.97	1.479	.948	4.96	.040
5	5.095	51.71	9.80	1.523	.996	5.16	.040
6	5.095	50.05	10.95	1.569	1.000	5.36	.040
7	5.096	47.66	13.30	1.635	1.001	5.73	.042
8	5.105	40.67	21.37	1.827	1.000	7.13	.054
9	5.118	36.49	28.56	1.944	1.000	8.40	.069
10	5.146	31.70	39.79	2.082	1.000	10.65	.108
11	5.171	29.12	47.54	2.165	1.000	12.34	.146
HUB	5.203	25.97	56.96	2.269	1.000	14.36	.192

TABLE III. - Concluded. BLADE GEOMETRY

(d) Second-stage stator

RP	PERCENT SPAN	RADII RI	RO	BLADE ANGLES KIC	KTC	KOC	DELTA INC	CONE ANGLE
TIP	0.	23.622	23.622	36.44	18.58	-16.16	5.75	.057
1	5.	23.108	23.129	36.03	19.25	-14.04	5.75	.279
2	10.	22.646	22.686	35.76	19.80	-12.44	5.74	.531
3	20.	21.728	21.802	35.53	20.71	-10.38	5.69	.975
4	30.	20.824	20.923	35.50	21.38	-9.53	5.64	1.318
5	36.	20.287	[illegible].400	35.74	21.82	-9.30	5.59	1.504
6	42.	19.757	19.884	36.24	22.33	-9.20	5.55	1.688
7	50.	19.060	19.204	37.03	23.07	-9.11	5.49	1.925
8	70.	17.367	17.566	39.81	25.20	-9.53	5.33	2.663
9	80.	16.547	16.786	42.24	26.63	-10.46	5.23	3.211
10	90.	15.739	16.040	45.90	28.35	-12.81	5.11	4.058
11	95.	15.338	15.682	48.24	29.31	-14.71	5.02	4.649
HUB	100.	14.869	15.237	51.08	30.44	-17.17	4.92	4.978

RP	BLADE THICKNESSES TI	TM	TO	AXIAL DIMENSIONS ZI	ZMC	ZTC	ZO
TIP	.125	.356	.125	30.141	32.232	31.540	34.500
1	.121	.350	.121	30.150	32.233	31.526	34.497
2	.117	.345	.117	30.157	32.233	31.512	34.494
3	.109	.335	.109	30.166	32.231	31.479	34.488
4	.102	.326	.102	30.172	32.232	31.442	34.487
5	.097	.321	.097	30.176	32.232	31.425	34.486
6	.092	.315	.092	30.181	32.232	31.412	34.486
7	.087	.308	.006	30.188	32.229	31.396	34.485
8	.072	.290	.072	30.214	32.226	31.368	34.487
9	.066	.281	.065	30.234	32.222	31.366	34.491
10	.059	.273	.058	30.259	32.217	31.371	34.501
11	.055	.269	.055	30.272	32.212	31.372	34.507
HUB	.051	.264	.051	30.288	32.205	31.373	34.516

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	TURNING RATIO	PHISS	CHOKE MARGIN
TIP	4.426	10.14	52.60	1.253	1.000	12.03	.301
1	4.426	11.00	50.07	1.280	1.000	11.07	.286
2	4.426	11.67	48.20	1.305	1.000	10.34	.274
3	4.427	12.59	45.90	1.360	1.000	9.35	.254
4	4.427	13.00	45.02	1.418	1.000	8.75	.239
5	4.427	13.24	45.04	1.455	1.000	8.60	.231
6	4.428	13.54	45.44	1.493	1.000	8.64	.224
7	4.428	13.99	46.14	1.547	1.000	8.75	.216
8	4.430	15.18	49.34	1.695	1.000	9.47	.199
9	4.432	15.95	52.70	1.778	1.000	10.52	.197
10	4.435	16.63	58.71	1.866	1.000	12.52	.211
11	4.438	16.88	62.95	1.913	1.000	13.93	.228
HUB	4.439	17.13	68.25	1.971	1.000	15.66	.248

TABLE IV. - OVERALL PERFORMANCE AT 100 PERCENT OF DESIGN SPEED

(a) Two-stage fan

READING NUMBER............................	16	27	38	49
TOTAL PRESSURE RATIO......................	2.315	2.347	2.230	2.038
TOTAL TEMPERATURE RATIO...................	1.346	1.354	1.330	1.301
ADIABATIC EFFICIENCY......................	0.782	0.777	0.779	0.749
POLYTROPIC EFFICIENCY.....................	0.806	0.802	0.803	0.773
WEIGHT FLOW...............................	31.86	31.69	32.66	32.81
WHEEL SPEED, RPM..........................	15995.8	16073.3	16057.4	16030.3
PERCENT OF DESIGN SPEED...................	99.7	100.2	100.1	99.9
DELTA.....................................	0.922	0.923	0.920	0.919
THETA.....................................	0.963	0.964	0.964	0.965

(b) First stage

READING NUMBER............................	16	27	38	49
ROTOR TOTAL PRESSURE RATIO................	1.561	1.581	1.523	1.505
STAGE TOTAL PRESSURE RATIO................	1.533	1.549	1.496	1.480
ROTOR TOTAL TEMPERATURE RATIO.............	1.168	1.173	1.159	1.155
STAGE TOTAL TEMPERATURE RATIO.............	1.167	1.172	1.159	1.155
ROTOR ADIABATIC EFFICIENCY................	0.810	0.810	0.806	0.803
STAGE ADIABATIC EFFICIENCY................	0.776	0.774	0.770	0.768
ROTOR POLYTROPIC EFFICIENCY...............	0.822	0.822	0.817	0.814
STAGE POLYTROPIC EFFICIENCY...............	0.789	0.787	0.783	0.780
ROTOR HEAD RISE COEFFICIENT...............	0.225	0.230	0.210	0.205
STAGE HEAD RISE COEFFICIENT...............	0.215	0.219	0.201	0.196
FLOW COEFFICIENT..........................	0.430	0.425	0.445	0.448
EQUIVALENT VALUES BASED ON STAGE INLET				
WEIGHT FLOW...............................	31.90	31.73	32.70	32.85
WEIGHT FLOW PER UNIT ANNULUS AREA.........	187.37	186.34	192.06	192.93
WEIGHT FLOW PER UNIT FRONTAL AREA.........	157.38	156.53	161.33	162.05

(c) Second stage

READING NUMBER............................	16	27	38	49
ROTOR TOTAL PRESSURE RATIO................	1.544	1.551	1.522	1.405
STAGE TOTAL PRESSURE RATIO................	1.511	1.515	1.491	1.377
ROTOR TOTAL TEMPERATURE RATIO.............	1.152	1.155	1.148	1.127
STAGE TOTAL TEMPERATURE RATIO.............	1.153	1.155	1.148	1.127
ROTOR ADIABATIC EFFICIENCY................	0.865	0.862	0.861	0.805
STAGE ADIABATIC EFFICIENCY................	0.817	0.810	0.816	0.755
ROTOR POLYTROPIC EFFICIENCY...............	0.873	0.870	0.869	0.814
STAGE POLYTROPIC EFFICIENCY...............	0.827	0.821	0.826	0.766
ROTOR HEAD RISE COEFFICIENT...............	0.283	0.284	0.269	0.215
STAGE HEAD RISE COEFFICIENT...............	0.268	0.268	0.255	0.202
FLOW COEFFICIENT..........................	0.463	0.453	0.490	0.500
EQUIVALENT VALUES BASED ON STAGE INLET				
WEIGHT FLOW...............................	22.49	22.17	23.52	23.84
WEIGHT FLOW PER UNIT ANNULUS AREA.........	176.50	174.05	184.66	187.16
WEIGHT FLOW PER UNIT FRONTAL AREA.........	122.95	121.25	128.64	130.38

TABLE V. - OVERALL PERFORMANCE AT 80 PERCENT OF DESIGN SPEED

(a) Two-stage fan

READING NUMBER	65	76	87	98	109
TOTAL PRESSURE RATIO	1.712	1.770	1.754	1.646	1.551
TOTAL TEMPERATURE RATIO	1.202	1.226	1.215	1.187	1.174
ADIABATIC EFFICIENCY	0.823	0.785	0.808	0.819	0.770
POLYTROPIC EFFICIENCY	0.836	0.801	0.823	0.831	0.783
WEIGHT FLOW	25.34	22.69	24.01	26.26	26.86
WHEEL SPEED, RPM	12909.8	12914.6	12919.4	12879.1	12933.9
PERCENT OF DESIGN SPEED	80.5	80.5	80.5	80.3	80.6
DELTA	0.948	0.955	0.951	0.943	0.942
THETA	0.969	0.971	0.971	0.975	0.972

(b) First stage

READING NUMBER	65	76	87	98	109
ROTOR TOTAL PRESSURE RATIO	1.348	1.368	1.359	1.330	1.324
STAGE TOTAL PRESSURE RATIO	1.333	1.346	1.342	1.318	1.311
ROTOR TOTAL TEMPERATURE RATIO	1.105	1.115	1.110	1.099	1.097
STAGE TOTAL TEMPERATURE RATIO	1.105	1.115	1.110	1.099	1.098
ROTOR ADIABATIC EFFICIENCY	0.853	0.813	0.830	0.857	0.858
STAGE ADIABATIC EFFICIENCY	0.818	0.769	0.795	0.827	0.826
ROTOR POLYTROPIC EFFICIENCY	0.859	0.821	0.838	0.863	0.864
STAGE POLYTROPIC EFFICIENCY	0.826	0.779	0.804	0.834	0.833
ROTOR HEAD RISE COEFFICIENT	0.227	0.238	0.233	0.217	0.212
STAGE HEAD RISE COEFFICIENT	0.218	0.225	0.223	0.210	0.204
FLOW COEFFICIENT	0.395	0.347	0.371	0.414	0.424
EQUIVALENT VALUES BASED ON STAGE INLET					
WEIGHT FLOW	25.35	22.70	24.02	26.28	26.87
WEIGHT FLOW PER UNIT ANNULUS AREA	148.92	133.34	141.11	154.35	157.85
WEIGHT FLOW PER UNIT FRONTAL AREA	125.09	112.01	118.53	129.65	132.59

(c) Second stage

READING NUMBER	65	76	87	98	109
ROTOR TOTAL PRESSURE RATIO	1.302	1.335	1.325	1.270	1.212
STAGE TOTAL PRESSURE RATIO	1.285	1.315	1.307	1.249	1.182
ROTOR TOTAL TEMPERATURE RATIO	1.088	1.099	1.095	1.080	1.069
STAGE TOTAL TEMPERATURE RATIO	1.088	1.099	1.095	1.080	1.069
ROTOR ADIABATIC EFFICIENCY	0.890	0.867	0.884	0.887	0.816
STAGE ADIABATIC EFFICIENCY	0.845	0.822	0.840	0.824	0.709
ROTOR POLYTROPIC EFFICIENCY	0.894	0.872	0.889	0.891	0.821
STAGE POLYTROPIC EFFICIENCY	0.850	0.829	0.846	0.829	0.715
ROTOR HEAD RISE COEFFICIENT	0.243	0.270	0.261	0.220	0.174
STAGE HEAD RISE COEFFICIENT	0.231	0.255	0.248	0.204	0.151
FLOW COEFFICIENT	0.477	0.416	0.444	0.505	0.520
EQUIVALENT VALUES BASED ON STAGE INLET					
WEIGHT FLOW	19.99	17.81	18.86	20.91	21.47
WEIGHT FLOW PER UNIT ANNULUS AREA	156.94	139.82	148.07	164.11	168.52
WEIGHT FLOW PER UNIT FRONTAL AREA	109.33	97.40	103.15	114.32	117.39

TABLE VI. - BLADE-ELEMENT DATA AT BLADE EDGES FOR

FIRST-STAGE ROTOR

(a) 100 Percent of design speed; reading 16

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.704	24.265	-1.5	40.7	69.7	61.2	289.0	1.189	9.92	1.583
2	23.978	23.594	-1.7	39.3	67.1	59.6	288.5	1.183	10.13	1.566
3	22.537	22.250	-0.9	38.8	64.2	56.3	288.3	1.172	10.13	1.572
4	21.092	20.907	-1.5	40.1	62.3	54.0	288.0	1.167	10.15	1.554
5	20.218	20.102	-1.4	42.4	61.0	52.9	288.0	1.166	10.15	1.525
6	19.342	19.294	-1.4	44.4	59.7	51.4	287.8	1.164	10.16	1.502
7	18.166	18.219	-1.6	45.4	58.1	46.9	287.9	1.163	10.16	1.503
8	15.133	15.552	-1.3	45.6	53.5	27.8	288.0	1.157	10.16	1.586
9	13.533	14.188	-1.0	46.9	50.9	15.8	287.9	1.156	10.15	1.598
10	11.854	12.845	-0.7	50.8	47.9	-1.0	288.1	1.163	10.15	1.618
11	10.973	12.172	-0.6	52.8	46.3	-9.5	288.4	1.165	10.14	1.610

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	155.3	200.6	446.9	315.8	155.2	151.9	-3.9	130.9	415.1	407.7
2	172.4	203.1	442.8	310.3	172.4	157.2	-5.2	128.7	402.7	396.3
3	184.7	208.2	424.1	292.6	184.7	162.2	-2.8	130.5	379.0	374.1
4	188.9	206.6	405.6	268.9	188.8	158.0	-5.0	133.1	353.9	350.8
5	191.0	204.4	393.4	250.0	191.0	150.9	-4.6	138.0	339.3	337.4
6	192.2	202.8	381.2	232.5	192.1	144.9	-4.8	141.9	324.5	323.7
7	193.0	208.9	364.9	214.4	192.9	146.5	-5.3	148.[illegible]	304.4	305.3
8	189.9	239.1	319.2	189.2	189.8	167.3	-4.2	170.8	252.4	259.1
9	186.3	256.6	295.3	182.4	186.2	175.5	-3.3	187.2	226.0	236.9
10	180.7	261.0	269.6	177.7	180.6	177.6	-2.1	217.7	198.0	214.5
11	176.4	292.0	255.4	179.2	176.4	176.7	-1.8	232.4	183.0	203.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.465	0.556	1.339	0.876	0.465	0.421	0.979	1.545
2	0.520	0.566	1.335	0.864	0.520	0.438	0.912	1.497
3	0.559	0.584	1.284	0.821	0.559	0.455	0.878	1.436
4	0.573	0.581	1.230	0.756	0.573	0.444	0.837	1.420
5	0.580	0.575	1.194	0.703	0.580	0.424	0.790	1.404
6	0.584	0.570	1.158	0.654	0.584	0.408	0.754	1.394
7	0.586	0.589	1.109	0.604	0.586	0.413	0.760	1.386
8	0.576	0.683	0.969	0.540	0.576	0.478	0.882	1.378
9	0.565	0.739	0.895	0.525	0.565	0.505	0.942	1.320
10	0.546	0.815	0.815	0.515	0.546	0.515	0.983	1.239
11	0.533	0.850	0.771	0.522	0.532	0.515	1.002	1.184

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	5.1	2.8	2.8	0.406	0.744	0.199	0.119	0.036	0.022
2	10.00	4.2	1.8	2.4	0.409	0.749	0.192	0.122	0.036	0.023
3	20.00	4.1	1.1	2.3	0.418	0.805	0.150	0.099	0.029	0.019
4	30.00	4.9	1.5	3.8	0.447	0.803	0.156	0.114	0.030	0.022
5	36.00	5.2	1.5	5.4	0.477	0.774	0.184	0.149	0.034	0.028
6	42.00	5.5	1.6	7.3	0.505	0.753	0.206	0.176	0.038	0.033
7	50.00	5.9	1.7	7.9	0.531	0.760	0.211	0.187	0.040	0.036
8	70.00	6.5	1.7	7.8	0.538	0.896	0.109	0.098	0.023	0.020
9	80.00	6.6	1.6	9.3	0.523	0.918	0.097	0.094	0.020	0.019
10	90.00	6.3	1.5	7.6	0.499	0.904	0.136	0.136	0.025	0.025
11	95.00	6.0	1.5	7.0	0.466	0.886	0.178	0.178	0.030	0.030

TABLE VI. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR FIRST-STAGE ROTOR

(b) 100 Percent of design speed; reading 27

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	24.704	24.265	-1.7	41.9	69.8	61.2	289.0	1.196	9.93	1.608
2	23.978	23.594	-1.8	40.9	67.3	59.5	288.5	1.191	10.14	1.588
3	22.537	22.250	-1.2	39.9	64.5	56.4	288.4	1.178	10.13	1.593
4	21.092	20.907	-1.7	41.0	62.6	53.9	287.9	1.173	10.15	1.579
5	20.218	20.102	-1.6	43.1	61.2	52.6	288.0	1.171	10.15	1.552
6	19.342	19.294	-1.6	45.2	60.1	51.4	288.0	1.169	10.15	1.526
7	18.166	18.219	-1.7	46.6	58.4	47.1	287.8	1.167	10.16	1.521
8	15.133	15.532	-1.3	46.6	54.0	28.5	287.8	1.160	10.16	1.594
9	13.533	14.188	-1.1	47.5	51.4	15.6	288.1	1.160	10.15	1.615
10	11.854	12.845	-0.8	51.2	48.4	-1.0	288.2	1.165	10.15	1.640
11	10.973	12.172	-0.7	54.1	46.9	-10.1	288.4	1.167	10.13	1.618

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	154.5	202.2	448.2	312.4	154.4	150.5	-4.6	135.0	416.2	408.8
2	171.3	204.5	442.9	305.1	171.2	154.6	-5.3	133.8	403.2	396.8
3	183.2	208.4	424.7	289.0	183.1	159.8	-3.8	133.8	379.4	374.6
4	187.3	208.2	406.4	266.6	187.2	157.1	-5.6	136.6	355.1	352.0
5	189.5	206.2	393.5	248.0	189.5	150.7	-5.2	140.8	339.7	337.8
6	190.6	204.3	382.2	230.8	190.6	144.0	-5.3	144.9	326.1	325.2
7	191.3	209.2	365.3	211.2	191.2	143.8	-5.6	151.9	305.6	306.5
8	188.3	238.1	320.3	186.0	188.2	163.6	-4.3	173.0	254.9	261.6
9	184.9	257.9	296.0	180.9	184.8	174.2	-3.5	190.1	227.7	238.7
10	179.2	281.5	270.1	176.4	179.2	176.3	-2.4	219.4	199.6	216.3
11	174.8	290.3	255.8	173.0	174.8	170.3	-2.1	235.0	184.6	204.8

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.463	0.559	1.343	0.864	0.463	0.416	0.974	1.554
2	0.516	0.568	1.335	0.847	0.516	0.429	0.903	1.503
3	0.554	0.583	1.285	0.808	0.554	0.447	0.873	1.446
4	0.568	0.584	1.232	0.748	0.568	0.441	0.839	1.432
5	0.575	0.579	1.194	0.696	0.575	0.423	0.795	1.413
6	0.579	0.574	1.160	0.648	0.578	0.404	0.756	1.408
7	0.581	0.589	1.109	0.594	0.581	0.405	0.752	1.399
8	0.571	0.679	0.972	0.531	0.571	0.467	0.869	1.400
9	0.560	0.741	0.897	0.520	0.560	0.501	0.943	1.336
10	0.542	0.816	0.817	0.511	0.542	0.511	0.984	1.255
11	0.527	0.843	0.772	0.503	0.527	0.495	0.975	1.199

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	5.2	3.0	2.8	0.419	0.741	0.207	0.124	0.038	0.023
2	10.00	4.4	1.9	2.3	0.425	0.742	0.204	0.133	0.038	0.025
3	20.00	4.4	1.4	2.4	0.431	0.801	0.158	0.104	0.030	0.020
4	30.00	5.2	1.8	3.7	0.457	0.807	0.157	0.113	0.030	0.022
5	36.00	5.4	1.8	5.1	0.485	0.784	0.180	0.143	0.034	0.027
6	42.00	5.9	2.0	7.2	0.513	0.762	0.202	0.171	0.038	0.032
7	50.00	6.3	2.0	8.1	0.543	0.763	0.212	0.187	0.041	0.036
8	70.00	7.0	2.2	8.5	0.552	0.890	0.117	0.104	0.024	0.021
9	80.00	7.0	2.0	9.0	0.531	0.921	0.095	0.091	0.019	0.019
10	90.00	6.8	2.0	7.7	0.507	0.918	0.117	0.117	0.022	0.022
11	95.00	6.6	2.0	6.4	0.493	0.881	0.188	0.188	0.032	0.032

TABLE VI. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR FIRST-STAGE ROTOR

(c) 100 Percent of design speed; reading 38

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.704	24.265	-1.9	36.3	69.1	61.6	288.9	1.170	9.92	1.515
2	23.978	23.594	-2.0	35.0	66.5	60.1	288.5	1.165	10.13	1.499
3	22.537	22.250	-1.5	34.6	63.5	57.1	288.3	1.156	10.14	1.514
4	21.092	20.907	-1.9	36.7	61.5	54.9	288.0	1.155	10.16	1.490
5	20.218	20.102	-1.8	39.3	60.3	54.1	288.0	1.155	10.15	1.463
6	19.342	19.294	-1.6	41.7	59.0	52.9	287.9	1.153	10.15	1.435
7	18.166	18.219	-1.8	42.7	57.3	48.1	288.0	1.154	10.16	1.447
8	15.133	15.532	-1.5	42.8	52.8	27.3	287.8	1.156	10.16	1.590
9	13.533	14.188	-1.2	44.7	50.1	15.0	288.0	1.158	10.16	1.615
10	11.854	12.845	-0.9	48.6	47.2	-0.6	288.0	1.165	10.15	1.614
11	10.973	12.172	-0.9	49.6	45.6	-7.9	288.4	1.166	10.13	1.623

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	161.1	196.0	450.4	332.1	161.0	158.1	-5.3	115.9	415.3	408.0
2	178.7	198.8	447.1	326.6	178.6	162.9	-6.4	113.9	403.5	397.0
3	191.5	203.6	429.4	308.5	191.5	167.7	-5.1	115.5	379.3	374.4
4	196.0	202.2	410.8	281.8	195.8	162.1	-6.6	120.9	354.5	351.4
5	198.2	199.1	399.3	262.4	198.1	153.9	-6.1	126.2	340.7	338.7
6	199.4	196.5	386.4	243.0	199.3	146.7	-5.7	130.8	325.3	324.5
7	200.2	204.5	370.4	225.0	200.1	150.2	-6.4	138.7	305.3	306.2
8	197.1	247.2	326.2	203.9	197.1	181.2	-5.3	168.1	254.7	261.4
9	193.4	266.5	301.6	196.1	193.4	189.4	-4.1	187.5	227.3	238.3
10	187.6	290.3	275.9	192.0	187.6	192.0	-3.1	217.7	199.2	215.9
11	183.1	304.4	261.7	199.3	183.1	197.4	-2.8	231.8	184.2	204.3

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.484	0.547	1.352	0.927	0.483	0.441	0.982	1.536
2	0.540	0.557	1.350	0.916	0.540	0.457	0.912	1.490
3	0.581	0.574	1.303	0.870	0.581	0.473	0.876	1.431
4	0.596	0.571	1.249	0.795	0.596	0.458	0.828	1.412
5	0.603	0.561	1.215	0.740	0.603	0.434	0.777	1.398
6	0.607	0.554	1.177	0.685	0.607	0.414	0.736	1.382
7	0.610	0.578	1.129	0.636	0.610	0.425	0.751	1.373
8	0.600	0.709	0.993	0.585	0.600	0.520	0.920	1.389
9	0.588	0.770	0.916	0.567	0.588	0.547	0.980	1.327
10	0.569	0.845	0.836	0.559	0.569	0.559	1.024	1.250
11	0.554	0.892	0.792	0.584	0.554	0.578	1.078	1.196

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	4.4	2.2	3.1	0.363	0.740	0.185	0.104	0.033	0.019
2	10.00	3.6	1.1	2.9	0.367	0.745	0.178	0.107	0.032	0.019
3	20.00	3.5	0.5	3.0	0.378	0.808	0.135	0.081	0.025	0.015
4	30.00	4.2	0.8	4.7	0.414	0.779	0.161	0.118	0.030	0.022
5	36.00	4.5	0.8	6.6	0.446	0.743	0.192	0.155	0.035	0.028
6	42.00	4.7	0.8	8.7	0.476	0.711	0.222	0.192	0.040	0.034
7	50.00	5.1	0.9	9.1	0.503	0.726	0.223	0.199	0.042	0.037
8	70.00	5.9	1.0	7.3	0.502	0.906	0.095	0.081	0.020	0.017
9	80.00	5.8	0.8	8.4	0.488	0.931	0.080	0.075	0.016	0.015
10	90.00	5.5	0.7	8.1	0.460	0.891	0.149	0.149	0.028	0.028
11	95.00	5.3	0.7	8.5	0.402	0.898	0.154	0.154	0.026	0.026

TABLE VI. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

FIRST-STAGE ROTOR

(d) 100 Percent of design speed; reading 49

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.704	24.265	-1.8	34.8	68.9	61.7	289.0	1.163	9.92	1.486
2	23.978	23.594	-2.1	33.6	66.3	60.2	288.5	1.158	10.13	1.472
3	22.537	22.250	-1.5	33.2	63.3	57.1	288.3	1.150	10.14	1.487
4	21.092	20.907	-1.8	35.4	61.3	54.9	287.9	1.149	10.15	1.471
5	20.218	20.102	-1.7	38.0	60.0	54.1	287.9	1.149	10.16	1.441
6	19.342	19.294	-1.6	40.5	58.7	53.1	288.0	1.148	10.16	1.413
7	18.166	18.219	-1.9	41.7	57.1	48.1	287.9	1.151	10.16	1.430
8	15.133	15.532	-1.5	42.1	52.6	27.1	287.9	1.155	10.16	1.582
9	13.533	14.188	-1.2	44.1	50.0	14.8	288.0	1.158	10.15	1.612
10	11.854	12.845	-1.0	48.1	47.0	-0.5	288.0	1.164	10.15	1.613
11	10.973	12.172	-0.9	49.2	45.4	-7.7	288.4	1.165	10.14	1.612

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	162.6	194.5	450.7	337.0	162.6	159.7	-5.2	111.1	415.2	407.8
2	180.1	197.2	447.3	331.1	180.0	164.3	-6.6	109.0	402.9	396.4
3	192.8	202.5	428.8	312.4	192.8	169.5	-5.2	110.7	377.9	373.1
4	197.3	201.7	410.4	285.8	197.2	164.4	-6.3	116.7	353.6	350.5
5	199.6	197.9	398.9	266.0	199.5	155.9	-6.0	121.9	339.4	337.5
6	200.9	195.0	386.7	246.9	200.8	148.3	-5.8	126.6	324.8	323.9
7	201.6	204.1	370.7	228.1	201.5	152.4	-6.6	135.8	304.6	305.5
8	198.2	248.3	326.4	207.0	198.1	184.2	-5.2	166.5	254.2	260.9
9	194.4	269.0	302.3	199.7	194.4	193.0	-4.2	187.3	227.3	238.3
10	188.6	292.4	276.7	195.4	188.6	195.4	-3.3	217.5	199.3	215.9
11	184.3	304.9	262.4	200.8	184.3	199.0	-2.9	230.9	184.0	204.1

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.488	0.545	1.353	0.943	0.488	0.447	0.982	1.531
2	0.544	0.554	1.352	0.931	0.544	0.462	0.913	1.485
3	0.585	0.573	1.302	0.883	0.585	0.479	0.879	1.422
4	0.600	0.571	1.249	0.809	0.600	0.465	0.834	1.403
5	0.608	0.559	1.215	0.752	0.608	0.441	0.781	1.388
6	0.612	0.551	1.178	0.698	0.612	0.419	0.739	1.375
7	0.614	0.578	1.130	0.646	0.614	0.431	0.756	1.367
8	0.603	0.713	0.994	0.594	0.603	0.529	0.930	1.383
9	0.591	0.778	0.919	0.578	0.591	0.558	0.993	1.326
10	0.572	0.852	0.839	0.570	0.572	0.570	1.036	1.250
11	0.558	0.894	0.794	0.589	0.558	0.583	1.080	1.194

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	4.2	2.0	3.3	0.349	0.735	0.181	0.102	0.032	0.018
2	10.00	3.4	0.9	3.0	0.354	0.739	0.175	0.105	0.032	0.019
3	20.00	3.2	0.2	3.1	0.364	0.804	0.132	0.081	0.025	0.015
4	30.00	3.9	0.5	4.7	0.400	0.781	0.155	0.113	0.029	0.021
5	36.00	4.2	0.6	6.7	0.433	0.737	0.191	0.155	0.035	0.028
6	42.00	4.5	0.6	8.9	0.463	0.701	0.222	0.193	0.040	0.035
7	50.00	4.9	0.7	9.1	0.493	0.715	0.227	0.204	0.043	0.038
8	70.00	5.6	0.8	7.1	0.491	0.907	0.094	0.081	0.020	0.017
9	80.00	5.7	0.7	8.2	0.477	0.929	0.081	0.077	0.017	0.016
10	90.00	5.4	0.6	8.2	0.449	0.891	0.148	0.148	0.028	0.028
11	95.00	5.1	0.5	8.8	0.397	0.888	0.166	0.166	0.029	0.029

TABLE VI. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

FIRST-STAGE ROTOR

(e) 80 Percent of design speed; reading 65

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.704	24.265	-0.2	40.2	71.0	63.2	289.6	1.111	10.00	1.338
2	23.978	23.594	-1.1	37.6	68.6	61.0	289.1	1.108	10.12	1.336
3	22.537	22.250	-2.0	35.5	66.1	58.1	288.2	1.101	10.14	1.336
4	21.092	20.907	-2.0	37.4	64.2	55.3	287.9	1.100	10.15	1.332
5	20.218	20.102	-1.9	39.9	63.0	53.2	287.8	1.103	10.15	1.329
6	19.342	19.294	-1.9	42.2	61.9	50.7	287.8	1.105	10.15	1.328
7	18.166	18.219	-1.9	44.0	60.3	45.7	287.8	1.106	10.15	1.332
8	15.133	15.532	-1.6	44.8	56.0	28.2	287.8	1.102	10.15	1.361
9	13.533	14.188	-1.1	46.3	53.3	15.0	287.9	1.103	10.15	1.380
10	11.854	12.845	-0.6	50.7	50.3	-3.3	288.1	1.110	10.14	1.409
11	10.973	12.172	-0.4	52.4	48.8	-11.0	288.1	1.111	10.13	1.404

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	115.0	151.9	353.7	257.7	115.0	116.1	-0.4	98.0	334.1	328.1
2	128.1	156.4	351.0	255.7	128.1	123.9	-2.5	95.4	324.3	319.1
3	137.5	159.5	338.7	245.3	137.4	129.8	-4.9	92.7	304.7	300.8
4	140.1	160.5	321.4	224.3	140.0	127.6	-4.9	97.4	284.4	281.9
5	141.6	162.8	311.6	208.5	141.5	124.9	-4.6	104.4	273.0	271.4
6	142.4	165.8	302.4	193.8	142.3	122.8	-4.8	111.4	262.0	261.3
7	142.8	171.9	288.1	177.3	142.7	123.7	-4.6	119.4	245.6	246.3
8	140.7	193.8	251.6	156.0	140.7	137.5	-3.8	136.5	204.8	210.2
9	138.2	210.9	231.2	150.8	138.2	145.6	-2.6	152.6	182.8	191.7
10	134.0	235.4	209.9	149.5	134.0	149.2	-1.4	182.1	160.1	173.5
11	130.7	244.4	198.6	151.8	130.7	149.0	-0.9	193.8	148.7	164.9

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.341	0.430	1.049	0.730	0.341	0.329	1.010	1.358
2	0.381	0.444	1.044	0.727	0.381	0.352	0.967	1.316
3	0.411	0.456	1.012	0.701	0.410	0.371	0.945	1.302
4	0.419	0.459	0.961	0.642	0.419	0.365	0.911	1.284
5	0.424	0.466	0.932	0.596	0.423	0.357	0.882	1.263
6	0.426	0.474	0.905	0.554	0.426	0.351	0.863	1.250
7	0.427	0.492	0.862	0.508	0.427	0.354	0.867	1.217
8	0.421	0.560	0.753	0.451	0.421	0.397	0.978	1.135
9	0.413	0.612	0.691	0.438	0.413	0.423	1.054	1.075
10	0.400	0.687	0.626	0.436	0.400	0.435	1.114	1.003
11	0.390	0.716	0.592	0.444	0.390	0.436	1.140	0.960

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.4	4.2	4.8	0.375	0.783	0.144	0.129	0.024	0.022
2	10.00	5.7	3.3	3.8	0.373	0.803	0.129	0.118	0.023	0.021
3	20.00	6.0	3.0	4.0	0.374	0.852	0.096	0.089	0.018	0.016
4	30.00	6.8	3.4	5.1	0.405	0.853	0.102	0.098	0.019	0.018
5	36.00	7.2	3.6	5.7	0.439	0.827	0.128	0.125	0.024	0.023
6	42.00	7.7	3.8	6.5	0.474	0.806	0.153	0.151	0.029	0.029
7	50.00	8.1	3.9	6.7	0.506	0.807	0.164	0.164	0.032	0.032
8	70.00	9.0	4.1	8.2	0.513	0.904	0.100	0.100	0.021	0.021
9	80.00	9.0	4.0	8.5	0.494	0.938	0.074	0.074	0.015	0.015
10	90.00	8.7	3.9	5.4	0.458	0.935	0.098	0.098	0.018	0.018
11	95.00	8.5	4.0	5.5	0.415	0.922	0.132	0.132	0.022	0.022

TABLE VI. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR FIRST-STAGE ROTOR

(f) 80 Percent of design speed; reading 76

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	24.704	24.265	-0.4	45.7	73.3	63.7	289.6	1.126	10.02	1.383
2	23.978	23.594	-1.0	45.4	71.0	62.4	289.0	1.124	10.13	1.369
3	22.537	22.250	-2.2	44.0	68.7	59.8	288.0	1.118	10.14	1.365
4	21.092	20.907	-2.2	46.0	67.1	57.2	287.9	1.116	10.14	1.357
5	20.218	20.102	-2.3	48.1	65.9	55.4	287.9	1.116	10.14	1.348
6	19.342	19.294	-2.2	49.7	64.8	52.2	288.0	1.116	10.14	1.350
7	18.166	18.219	-2.2	50.9	63.3	46.5	287.8	1.117	10.14	1.354
8	15.133	15.532	-1.9	48.9	59.4	28.2	287.9	1.107	10.14	1.364
9	13.533	14.188	-1.4	49.3	56.9	14.1	287.8	1.107	10.14	1.390
10	11.854	12.845	-0.8	52.9	54.0	-3.4	288.0	1.110	10.14	1.401
11	10.973	12.172	-0.6	55.7	52.4	-12.7	288.1	1.111	10.13	1.390

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	100.5	154.7	350.6	243.8	100.5	108.1	-0.6	110.8	335.3	329.3
2	112.6	155.7	346.3	236.3	112.6	109.4	-2.1	110.8	325.4	320.2
3	121.0	156.6	333.2	223.6	121.0	112.6	-4.6	108.8	305.9	302.0
4	123.2	157.9	316.2	202.6	123.1	109.6	-4.8	113.6	286.5	284.0
5	124.4	158.7	304.6	186.3	124.3	105.9	-4.9	118.2	273.1	271.5
6	125.1	162.7	293.3	171.7	125.0	105.2	-4.9	124.1	260.5	259.8
7	125.6	170.2	279.3	156.2	125.5	107.4	-4.9	132.0	244.6	245.4
8	123.7	189.7	242.5	141.4	123.6	124.6	-4.1	143.1	204.5	209.9
9	121.4	208.1	222.0	139.9	121.3	135.7	-3.0	157.8	182.9	191.8
10	117.7	227.6	200.1	137.5	117.7	137.2	-1.7	181.6	160.0	173.4
11	114.9	235.0	188.3	135.8	114.9	132.4	-1.2	194.1	148.0	164.2

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.297	0.436	1.037	0.686	0.297	0.304	1.075	1.434
2	0.334	0.439	1.027	0.666	0.334	0.309	0.971	1.394
3	0.360	0.444	0.992	0.634	0.360	0.319	0.931	1.383
4	0.367	0.448	0.942	0.575	0.367	0.311	0.891	1.354
5	0.371	0.451	0.908	0.529	0.370	0.301	0.852	1.322
6	0.373	0.462	0.874	0.488	0.373	0.299	0.842	1.292
7	0.374	0.484	0.832	0.445	0.374	0.306	0.856	1.260
8	0.368	0.546	0.723	0.407	0.368	0.358	1.008	1.171
9	0.361	0.602	0.661	0.405	0.361	0.393	1.118	1.109
10	0.350	0.662	0.595	0.400	0.350	0.399	1.166	1.026
11	0.341	0.685	0.560	0.396	0.341	0.386	1.153	0.975

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	8.8	6.5	5.3	0.423	0.773	0.170	0.148	0.028	0.025
2	10.00	8.2	5.7	5.2	0.436	0.757	0.183	0.166	0.031	0.028
3	20.00	8.7	5.7	5.7	0.446	0.788	0.161	0.148	0.028	0.026
4	30.00	9.8	6.4	7.0	0.480	0.788	0.171	0.163	0.030	0.029
5	36.00	10.1	6.5	7.9	0.514	0.770	0.195	0.191	0.034	0.034
6	42.00	10.5	6.6	8.0	0.545	0.770	0.207	0.205	0.038	0.037
7	50.00	11.1	6.9	7.5	0.578	0.776	0.218	0.218	0.042	0.042
8	70.00	12.4	7.5	8.2	0.562	0.870	0.149	0.149	0.031	0.031
9	80.00	12.5	7.6	7.5	0.527	0.927	0.098	0.098	0.020	0.020
10	90.00	12.3	7.5	5.3	0.491	0.921	0.131	0.131	0.024	0.024
11	95.00	12.1	7.5	3.8	0.468	0.890	0.203	0.203	0.034	0.034

TABLE VI. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR FIRST-STAGE ROTOR

(g) 80 Percent of design speed; reading 87

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.704	24.265	-0.5	42.8	72.2	63.0	289.7	1.120	10.01	1.366
2	23.978	23.594	-1.2	41.6	69.8	61.6	289.0	1.117	10.13	1.353
3	22.537	22.250	-2.2	39.6	67.5	59.1	288.0	1.109	10.14	1.352
4	21.092	20.907	-2.2	41.5	65.7	56.3	287.9	1.108	10.14	1.344
5	20.218	20.102	-2.1	43.8	64.5	53.9	287.8	1.110	10.14	1.343
6	19.342	19.294	-2.1	45.8	63.4	51.0	287.8	1.111	10.14	1.343
7	18.166	18.219	-2.0	47.4	62.0	46.1	287.9	1.112	10.15	1.346
8	15.133	15.532	-1.7	47.2	57.6	28.4	287.8	1.104	10.14	1.362
9	13.533	14.188	-1.2	48.2	55.0	14.5	287.9	1.105	10.14	1.382
10	11.854	12.845	-0.8	52.1	52.1	-3.3	287.9	1.110	10.14	1.406
11	10.973	12.172	-0.5	54.9	50.5	-12.0	288.2	1.110	10.13	1.389

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	107.8	155.2	352.6	250.9	107.8	113.9	-0.9	105.4	334.9	328.9
2	120.2	156.3	348.7	245.5	120.2	116.9	-2.4	103.8	324.9	319.7
3	129.0	157.0	336.4	235.1	128.9	120.9	-5.0	100.2	305.7	301.8
4	131.4	158.8	319.3	214.2	131.3	118.9	-5.1	105.2	285.9	283.4
5	132.7	161.7	308.4	196.1	132.6	116.6	-4.8	112.0	273.6	272.0
6	133.5	165.3	297.8	183.0	133.4	115.2	-4.8	118.5	261.4	260.7
7	133.9	171.9	284.7	167.5	133.9	116.2	-4.8	126.6	246.5	247.2
8	132.1	190.5	246.6	147.3	132.0	129.5	-3.9	139.7	204.4	209.8
9	129.7	208.4	226.1	143.5	129.7	139.0	-2.7	155.3	182.4	191.2
10	125.8	229.9	205.0	141.3	125.8	141.1	-1.7	181.5	160.1	173.5
11	122.8	235.7	193.1	138.5	122.8	135.4	-1.1	193.0	148.0	164.1

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.319	0.438	1.044	0.708	0.319	0.321	1.057	1.397
2	0.357	0.442	1.036	0.695	0.357	0.331	0.973	1.356
3	0.385	0.447	1.003	0.669	0.384	0.344	0.938	1.351
4	0.392	0.452	0.953	0.611	0.392	0.339	0.905	1.324
5	0.396	0.461	0.921	0.564	0.396	0.332	0.879	1.297
6	0.399	0.471	0.889	0.522	0.398	0.328	0.864	1.273
7	0.400	0.491	0.850	0.478	0.400	0.332	0.868	1.248
8	0.394	0.549	0.736	0.424	0.394	0.373	0.981	1.151
9	0.387	0.604	0.674	0.416	0.387	0.403	1.071	1.088
10	0.375	0.670	0.611	0.412	0.375	0.411	1.121	1.015
11	0.366	0.688	0.575	0.404	0.366	0.395	1.103	0.964

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	7.6	5.4	4.6	0.401	0.778	0.159	0.140	0.027	0.024
2	10.00	7.0	4.5	4.4	0.406	0.774	0.160	0.146	0.028	0.025
3	20.00	7.4	4.4	5.0	0.408	0.823	0.125	0.114	0.022	0.020
4	30.00	8.4	5.0	6.1	0.440	0.817	0.137	0.131	0.025	0.024
5	36.00	8.8	5.1	6.5	0.475	0.801	0.158	0.155	0.029	0.028
6	42.00	9.2	5.3	6.8	0.509	0.790	0.178	0.177	0.033	0.033
7	50.00	9.8	5.6	7.1	0.541	0.792	0.190	0.190	0.037	0.037
8	70.00	10.6	5.8	8.4	0.542	0.865	0.125	0.125	0.026	0.026
9	80.00	10.7	5.7	8.0	0.517	0.925	0.096	0.096	0.020	0.020
10	90.00	10.5	5.7	5.4	0.484	0.930	0.111	0.111	0.021	0.021
11	95.00	10.2	5.7	4.5	0.466	0.892	0.189	0.189	0.032	0.032

TABLE VI. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

FIRST-STAGE ROTOR

(h) 80 Percent of design speed; reading 98

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	24.704	24.265	-0.8	36.1	70.2	62.7	289.4	1.103	9.99	1.311
2	23.978	23.594	-1.3	33.8	67.7	60.9	288.9	1.098	10.12	1.308
3	22.537	22.250	-2.2	32.1	65.1	57.8	288.0	1.094	10.15	1.311
4	21.092	20.907	-2.3	33.8	63.2	54.8	288.1	1.094	10.15	1.314
5	20.218	20.102	-2.1	36.4	61.9	52.7	287.9	1.096	10.15	1.311
6	19.342	19.294	-2.0	39.0	60.8	50.2	287.8	1.099	10.15	1.308
7	18.166	18.219	-1.9	40.9	59.2	45.5	287.9	1.100	10.15	1.312
8	15.133	15.532	-1.6	42.6	54.8	28.3	287.8	1.098	10.15	1.351
9	13.533	14.188	-1.1	44.9	52.3	15.8	287.9	1.101	10.15	1.370
10	11.854	12.845	-0.7	49.5	49.2	-2.7	288.0	1.109	10.14	1.400
11	10.973	12.172	-0.5	50.8	47.6	-10.1	288.1	1.110	10.13	1.404

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	120.3	151.7	355.0	266.8	120.3	122.6	-1.7	89.4	332.3	326.4
2	133.7	155.6	353.0	265.7	133.7	139.4	-3.0	86.5	323.7	318.6
3	143.6	160.0	341.0	254.0	143.5	135.5	-5.6	85.0	303.8	299.9
4	146.4	162.2	324.4	233.7	146.3	134.7	-5.8	90.2	283.7	281.2
5	147.9	163.9	314.0	217.5	147.8	131.9	-5.3	97.2	271.8	270.2
6	148.7	166.3	304.6	202.0	148.6	129.2	-5.2	104.7	260.6	260.0
7	149.2	172.2	290.8	185.8	149.1	130.2	-5.0	112.8	244.7	245.4
8	147.0	195.2	254.6	163.3	146.9	143.8	-4.0	132.0	204.0	209.4
9	144.3	212.2	235.7	156.1	144.2	150.2	-2.8	149.9	183.6	192.5
10	139.9	237.7	213.9	154.5	139.8	154.3	-1.8	180.8	160.1	173.5
11	136.4	248.6	202.5	159.5	136.4	157.0	-1.1	192.7	148.5	164.7

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT		
1	0.357	0.431	1.054	0.759	0.357	0.349	1.019	1.351
2	0.399	0.444	1.052	0.759	0.398	0.369	0.968	1.288
3	0.430	0.459	1.020	0.729	0.429	0.389	0.945	1.270
4	0.438	0.465	0.971	0.671	0.438	0.387	0.921	1.263
5	0.443	0.470	0.941	0.624	0.443	0.379	0.893	1.240
6	0.446	0.477	0.913	0.579	0.445	0.370	0.869	1.224
7	0.447	0.494	0.872	0.533	0.447	0.374	0.873	1.195
8	0.440	0.565	0.763	0.472	0.440	0.416	0.979	1.118
9	0.432	0.617	0.705	0.454	0.432	0.437	1.041	1.073
10	0.418	0.695	0.640	0.452	0.418	0.451	1.104	0.999
11	0.407	0.729	0.605	0.468	0.407	0.461	1.151	0.955

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	5.6	3.4	4.2	0.344	0.785	0.132	0.120	0.023	0.021
2	10.00	4.9	2.4	3.7	0.339	0.812	0.112	0.103	0.020	0.018
3	20.00	5.1	2.1	3.7	0.346	0.857	0.087	0.080	0.016	0.015
4	30.00	5.9	2.5	4.6	0.375	0.867	0.086	0.082	0.016	0.015
5	36.00	6.2	2.5	5.2	0.409	0.836	0.113	0.111	0.021	0.021
6	42.00	6.6	2.7	6.1	0.444	0.806	0.143	0.142	0.027	0.027
7	50.00	7.0	2.8	6.5	0.475	0.807	0.154	0.154	0.030	0.030
8	70.00	7.8	2.9	8.3	0.486	0.913	0.085	0.085	0.018	0.018
9	80.00	7.9	3.0	9.3	0.478	0.933	0.077	0.077	0.016	0.016
10	90.00	7.5	2.7	6.0	0.444	0.924	0.110	0.110	0.021	0.021
11	95.00	7.3	2.8	6.4	0.387	0.926	0.119	0.119	0.020	0.020

TABLE VI. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES FOR

FIRST-STAGE ROTOR

(i) 80 Percent of design speed; reading 109

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.704	24.265	-0.9	34.2	69.8	62.8	289.4	1.098	9.98	1.294
2	23.978	23.594	-1.3	32.0	67.2	60.8	289.0	1.094	10.12	1.293
3	22.537	22.250	-2.1	30.6	64.5	57.6	288.1	1.091	10.15	1.299
4	21.092	20.907	-2.3	32.3	62.8	54.7	288.0	1.092	10.15	1.304
5	20.218	20.102	-2.1	34.5	61.5	52.4	287.9	1.094	10.15	1.304
6	19.342	19.294	-2.0	37.3	60.3	50.1	287.9	1.097	10.15	1.297
7	18.166	18.219	-1.8	39.6	58.5	45.4	287.8	1.099	10.15	1.301
8	15.133	15.532	-1.5	41.3	54.1	28.1	287.6	1.098	10.15	1.354
9	13.533	14.188	-1.0	43.9	51.5	15.5	287.9	1.101	10.15	1.374
10	11.854	12.845	-0.6	48.4	48.5	-2.0	287.9	1.109	10.14	1.406
11	10.973	12.172	-0.5	49.9	47.0	-9.4	288.1	1.110	10.13	1.408

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	123.8	151.1	358.1	273.6	123.8	125.0	-1.9	84.8	334.2	328.2
2	137.5	155.9	355.0	270.8	137.5	132.2	-3.0	82.6	324.2	319.0
3	147.6	160.9	342.9	258.5	147.5	138.5	-5.4	82.0	304.1	300.2
4	150.5	164.3	328.6	240.1	150.4	138.9	-5.9	87.8	286.2	283.7
5	152.0	166.4	317.9	224.6	151.9	137.1	-5.6	94.3	273.7	272.1
6	152.8	168.0	308.1	208.4	152.7	133.6	-5.4	101.8	262.3	261.6
7	153.4	173.6	293.7	190.4	153.3	133.7	-4.9	110.7	245.6	246.3
8	151.0	197.7	257.3	168.4	151.0	148.6	-4.0	130.4	204.3	209.7
9	148.3	215.8	238.2	161.4	148.3	155.5	-2.6	149.5	183.8	192.7
10	143.8	240.7	217.0	160.0	143.8	159.9	-1.6	179.9	160.9	174.3
11	140.3	251.3	205.8	164.0	140.3	161.8	-1.3	192.3	149.3	165.6

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.368	0.431	1.064	0.780	0.368	0.356	1.010	1.322
2	0.410	0.446	1.059	0.775	0.410	0.378	0.961	1.272
3	0.442	0.462	1.027	0.743	0.442	0.398	0.939	1.250
4	0.451	0.472	0.985	0.690	0.451	0.399	0.924	1.265
5	0.456	0.478	0.954	0.645	0.456	0.394	0.903	1.240
6	0.459	0.482	0.925	0.598	0.458	0.384	0.875	1.223
7	0.460	0.499	0.881	0.547	0.460	0.384	0.872	1.189
8	0.453	0.573	0.772	0.488	0.453	0.430	0.984	1.112
9	0.444	0.628	0.714	0.470	0.444	0.453	1.049	1.067
10	0.430	0.704	0.649	0.468	0.430	0.468	1.112	0.999
11	0.419	0.738	0.615	0.482	0.419	0.475	1.153	0.959

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	5.2	2.9	4.4	0.326	0.781	0.128	0.115	0.022	0.020
2	10.00	4.3	1.9	3.6	0.325	0.808	0.110	0.101	0.020	0.018
3	20.00	4.5	1.5	3.6	0.334	0.853	0.085	0.080	0.016	0.015
4	30.00	5.4	2.0	4.5	0.361	0.858	0.088	0.084	0.016	0.016
5	36.00	5.7	2.1	4.9	0.391	0.839	0.107	0.105	0.020	0.020
6	42.00	6.1	2.2	5.9	0.427	0.799	0.143	0.142	0.027	0.027
7	50.00	6.4	2.1	6.4	0.462	0.792	0.161	0.161	0.032	0.032
8	70.00	7.1	2.2	8.1	0.470	0.926	0.071	0.071	0.015	0.015
9	80.00	7.2	2.2	8.9	0.461	0.941	0.067	0.067	0.014	0.014
10	90.00	6.8	2.1	6.7	0.425	0.937	0.089	0.089	0.017	0.017
11	95.00	6.7	2.2	7.1	0.375	0.932	0.107	0.107	0.018	0.018

TABLE VII. - BLADE-ELEMENT DATA AT BLADE EDGES FOR

FIRST-STAGE STATOR

(a) 100 Percent of design speed; reading 16

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	23.757	23.762	37.1	2.5	37.1	2.5	343.6	1.000	15.71	0.982
2	23.167	23.200	35.4	2.1	35.4	2.1	341.2	1.000	15.86	0.985
3	21.981	22.068	34.8	0.6	34.8	0.6	337.8	1.000	15.93	0.986
4	20.787	20.927	36.1	0.9	36.1	0.9	336.1	1.000	15.78	0.987
5	20.071	20.244	38.5	1.0	38.5	1.0	335.7	1.000	15.49	0.987
6	19.350	19.558	40.5	-0.6	40.5	-0.6	334.9	1.000	15.26	0.984
7	18.387	18.649	41.6	-1.0	41.6	-1.0	334.7	1.000	15.26	0.985
8	15.961	16.388	42.2	0.9	42.2	0.9	333.4	1.000	16.11	0.986
9	14.732	15.263	44.0	1.0	44.0	1.0	333.0	1.000	16.23	0.984
10	13.492	14.143	49.2	3.8	49.2	3.8	335.1	1.000	16.43	0.959
11	12.868	13.586	52.1	0.1	52.1	0.1	335.9	1.000	16.32	0.930

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	221.6	170.8	221.6	170.8	176.7	170.7	133.7	7.4	0.	0.
2	226.2	177.0	226.2	177.0	184.4	176.9	131.1	6.4	0.	0.
3	231.5	180.7	231.5	180.7	190.0	180.7	132.1	1.9	0.	0.
4	227.2	175.4	227.2	175.4	183.5	175.4	133.9	2.7	0.	0.
5	222.0	167.3	222.0	167.3	173.7	167.3	138.2	3.0	0.	0.
6	217.7	159.0	217.7	159.0	165.5	159.0	141.5	-1.8	0.	0.
7	222.1	159.4	222.1	159.4	166.0	159.4	147.5	-2.7	0.	0.
8	247.6	179.0	247.6	179.0	183.5	178.9	166.2	2.8	0.	0.
9	259.6	185.9	259.6	185.9	186.8	165.8	180.3	3.2	0.	0.
10	274.0	180.0	274.0	180.0	179.1	179.6	207.3	11.8	0.	0.
11	278.6	161.3	278.6	161.3	171.2	161.3	219.8	0.4	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.619	0.470	0.619	0.470	0.493	0.469	0.966	0.780
2	0.635	0.489	0.635	0.489	0.518	0.489	0.959	0.743
3	0.655	0.503	0.655	0.503	0.537	0.503	0.951	0.724
4	0.643	0.489	0.643	0.489	0.520	0.489	0.956	0.731
5	0.628	0.465	0.628	0.465	0.491	0.465	0.963	0.762
6	0.616	0.442	0.616	0.442	0.468	0.442	0.961	0.781
7	0.629	0.443	0.629	0.443	0.470	0.443	0.960	0.801
8	0.710	0.501	0.710	0.501	0.526	0.501	0.975	0.840
9	0.748	0.522	0.748	0.522	0.538	0.522	0.995	0.884
10	0.792	0.503	0.792	0.503	0.518	0.502	1.002	1.030
11	0.806	0.448	0.806	0.448	0.495	0.448	0.942	1.103

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	1.3	-4.7	15.8	0.448	0.	0.079	0.079	0.030	0.030
2	10.00	-0.2	-6.2	13.3	0.423	0.	0.062	0.062	0.023	0.023
3	20.00	-0.8	-6.7	10.0	0.419	0.	0.056	0.056	0.020	0.020
4	30.00	0.2	-5.6	9.5	0.421	0.	0.055	0.055	0.019	0.019
5	36.00	2.2	-3.6	9.3	0.443	0.	0.054	0.054	0.017	0.017
6	42.00	3.4	-2.3	7.5	0.475	0.	0.073	0.073	0.023	0.023
7	50.00	3.4	-2.3	7.0	0.483	0.	0.065	0.065	0.019	0.019
8	70.00	0.4	-5.0	9.2	0.447	0.	0.050	0.050	0.013	0.013
9	80.00	-0.2	-5.6	10.1	0.445	0.	0.051	0.051	0.012	0.012
10	90.00	2.0	-3.1	14.8	0.497	0.	0.122	0.122	0.027	0.027
11	95.00	3.4	-1.6	12.6	0.583	0.	0.201	0.201	0.043	0.043

TABLE VII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

FIRST-STAGE STATOR

(b) 100 Percent of design speed; reading 27

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.757	23.762	38.3	2.5	38.3	2.5	345.7	1.000	15.97	0.981
2	23.167	23.200	37.0	2.2	37.0	2.2	343.5	1.000	16.10	0.983
3	21.981	22.068	35.9	1.2	35.9	1.2	339.7	1.000	16.14	0.985
4	20.787	20.927	37.0	1.2	37.0	1.2	337.7	1.000	16.03	0.984
5	20.071	20.244	39.1	1.3	39.1	1.3	337.2	1.000	15.75	0.985
6	19.350	19.558	41.3	-0.5	41.3	-0.5	336.6	1.000	15.49	0.984
7	18.387	18.649	42.8	-0.8	42.8	-0.8	335.8	1.000	15.44	0.986
8	15.961	16.388	43.2	1.0	43.2	1.0	333.9	1.000	16.18	0.987
9	14.732	15.263	44.6	1.4	44.6	1.4	334.0	1.000	16.40	0.980
10	13.492	14.143	49.6	4.3	49.6	4.3	335.8	1.000	16.65	0.947
11	12.868	13.586	53.4	0.4	53.4	0.4	336.7	1.000	16.39	0.930

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	222.7	170.2	222.7	170.2	174.9	170.1	137.9	7.3	0.	0.
2	226.7	175.1	226.7	175.1	181.1	175.0	136.3	6.7	0.	0.
3	230.9	178.4	230.9	178.4	187.0	178.4	135.5	3.6	0.	0.
4	228.4	173.7	228.4	173.7	182.4	173.6	137.4	3.6	0.	0.
5	223.5	165.9	223.5	165.9	173.4	165.9	141.0	3.7	0.	0.
6	218.9	157.7	218.9	157.7	164.4	157.7	144.5	-1.3	0.	0.
7	221.6	156.9	221.6	156.9	162.7	156.9	150.5	-2.1	0.	0.
8	245.7	174.8	245.7	174.8	179.0	174.8	168.3	2.9	0.	0.
9	260.5	181.0	260.5	181.0	185.4	181.0	183.1	4.4	0.	0.
10	274.3	173.7	274.3	173.7	177.7	173.2	208.9	13.2	0.	0.
11	276.9	156.3	276.9	156.3	165.0	156.3	222.3	1.1	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.620	0.467	0.620	0.467	0.487	0.466	0.973	0.808
2	0.634	0.482	0.634	0.482	0.507	0.482	0.966	0.782
3	0.651	0.495	0.651	0.495	0.527	0.495	0.954	0.754
4	0.645	0.482	0.645	0.482	0.515	0.482	0.952	0.758
5	0.631	0.460	0.631	0.460	0.490	0.460	0.957	0.782
6	0.617	0.437	0.617	0.437	0.464	0.437	0.959	0.801
7	0.627	0.435	0.627	0.435	0.460	0.435	0.964	0.824
8	0.703	0.488	0.703	0.488	0.512	0.488	0.976	0.863
9	0.750	0.507	0.750	0.507	0.534	0.507	0.976	0.906
10	0.792	0.484	0.792	0.484	0.513	0.483	0.975	1.043
11	0.799	0.433	0.799	0.433	0.476	0.433	0.947	1.130

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	2.4	-3.5	15.7	0.460	0.	0.085	0.085	0.033	0.033
2	10.00	1.3	-4.6	13.4	0.441	0.	0.072	0.072	0.027	0.027
3	20.00	0.3	-5.6	10.6	0.430	0.	0.060	0.060	0.021	0.021
4	30.00	1.1	-4.7	9.9	0.436	0.	0.064	0.064	0.022	0.022
5	36.00	2.8	-3.0	9.6	0.456	0.	0.063	0.063	0.021	0.021
6	42.00	4.2	-1.5	7.7	0.487	0.	0.072	0.072	0.023	0.023
7	50.00	4.5	-1.1	7.2	0.496	0.	0.059	0.059	0.018	0.018
8	70.00	1.5	-4.0	9.3	0.462	0.	0.048	0.048	0.012	0.012
9	80.00	0.4	-4.9	10.5	0.467	0.	0.064	0.064	0.015	0.015
10	90.00	2.5	-2.7	15.3	0.520	0.	0.155	0.155	0.034	0.034
11	95.00	4.7	-0.3	12.9	0.600	0.	0.203	0.203	0.043	0.043

TABLE VII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR FIRST-STAGE STATOR

(c) 100 Percent of design speed; reading 38

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.757	23.762	32.7	1.2	32.7	1.2	338.2	1.000	15.02	0.984
2	23.167	23.200	31.2	0.8	31.2	0.8	336.0	1.000	15.19	0.988
3	21.981	22.068	30.6	-0.4	30.6	-0.4	333.2	1.000	15.34	0.989
4	20.787	20.927	32.8	-0.1	32.8	-0.1	332.6	1.000	15.13	0.991
5	20.071	20.244	35.4	0.0	35.4	0.0	332.6	1.000	14.85	0.989
6	19.350	19.558	37.9	-1.4	37.9	-1.4	332.0	1.000	14.58	0.986
7	18.387	18.649	38.9	-1.4	38.9	-1.4	332.2	1.000	14.70	0.983
8	15.961	16.388	39.3	0.6	39.3	0.6	332.9	1.000	16.15	0.979
9	14.732	15.263	41.7	0.8	41.7	0.8	333.5	1.000	16.40	0.982
10	13.492	14.143	46.9	1.8	46.9	1.8	335.5	1.000	16.39	0.965
11	12.868	13.586	49.0	-0.5	49.0	-0.5	336.1	1.000	16.45	0.924

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	219.2	173.4	219.2	173.4	184.5	173.4	118.4	3.7	0.	0.
2	224.2	180.7	224.2	180.7	191.8	180.7	116.0	2.6	0.	0.
3	229.3	186.5	229.3	186.5	197.3	186.4	116.9	-1.2	0.	0.
4	224.6	180.8	224.6	180.8	188.9	180.8	121.6	-0.4	0.	0.
5	218.0	171.7	218.0	171.7	177.6	171.7	126.4	0.1	0.	0.
6	212.5	163.0	212.5	163.0	167.7	162.9	130.4	-4.1	0.	0.
7	219.0	165.2	219.0	165.2	170.5	165.2	137.5	-4.1	0.	0.
8	258.4	197.5	258.4	197.5	200.0	197.5	163.5	2.1	0.	0.
9	271.4	209.8	271.4	209.8	202.5	209.8	180.6	3.1	0.	0.
10	283.7	206.4	283.7	206.4	193.7	206.3	207.3	6.4	0.	0.
11	290.5	190.7	290.5	190.7	190.5	190.7	219.3	-1.7	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.617	0.481	0.617	0.481	0.519	0.481	0.940	0.657
2	0.634	0.504	0.634	0.504	0.543	0.504	0.942	0.634
3	0.653	0.523	0.653	0.523	0.562	0.523	0.945	0.653
4	0.639	0.507	0.639	0.507	0.537	0.507	0.957	0.639
5	0.619	0.480	0.619	0.480	0.504	0.480	0.967	0.665
6	0.602	0.455	0.602	0.455	0.476	0.455	0.971	0.700
7	0.622	0.462	0.622	0.462	0.484	0.462	0.969	0.724
8	0.745	0.556	0.745	0.556	0.576	0.556	0.987	0.768
9	0.786	0.593	0.786	0.593	0.586	0.593	1.036	0.842
10	0.823	0.581	0.823	0.581	0.562	0.581	1.065	1.002
11	0.845	0.534	0.845	0.534	0.554	0.534	1.001	1.061

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-3.1	-9.1	14.5	0.409	0.	0.072	0.072	0.028	0.028
2	10.00	-4.5	-10.4	12.0	0.383	0.	0.052	0.052	0.019	0.019
3	20.00	-5.0	-10.9	9.0	0.369	0.	0.044	0.044	0.015	0.015
4	30.00	-3.1	-9.0	8.5	0.377	0.	0.038	0.038	0.013	0.013
5	36.00	-0.9	-6.7	8.4	0.400	0.	0.050	0.050	0.016	0.016
6	42.00	0.8	-5.0	6.7	0.431	0.	0.063	0.063	0.020	0.020
7	50.00	0.6	-5.0	6.5	0.437	0.	0.076	0.076	0.023	0.023
8	70.00	-2.5	-7.9	8.9	0.396	0.	0.069	0.069	0.018	0.018
9	80.00	-2.5	-7.8	9.9	0.382	0.	0.055	0.055	0.013	0.013
10	90.00	-0.2	-5.3	12.8	0.425	0.	0.097	0.097	0.021	0.021
11	95.00	0.3	-4.7	12.0	0.500	0.	0.204	0.204	0.043	0.043

TABLE VII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR FIRST-STAGE STATOR

(d) 100 Percent of design speed; reading 49

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.757	23.762	31.3	0.9	31.3	0.9	336.2	1.000	14.74	0.986
2	23.167	23.200	29.8	0.5	29.8	0.5	334.1	1.000	14.91	0.989
3	21.981	22.068	29.3	-0.9	29.3	-0.9	331.5	1.000	15.08	0.990
4	20.787	20.927	31.5	-0.6	31.5	-0.6	330.9	1.000	14.94	0.990
5	20.071	20.244	34.1	-0.5	34.1	-0.5	330.9	1.000	14.63	0.989
6	19.350	19.558	36.6	-1.7	36.6	-1.7	330.6	1.000	14.35	0.988
7	18.387	18.649	37.8	-1.3	37.8	-1.3	331.3	1.000	14.52	0.982
8	15.961	16.388	38.5	0.6	38.5	0.6	332.4	1.000	16.07	0.978
9	14.732	15.263	41.1	0.9	41.1	0.9	333.3	1.000	16.37	0.982
10	13.492	14.143	46.4	1.5	46.4	1.5	335.4	1.000	16.37	0.964
11	12.868	13.586	48.7	-0.4	48.7	-0.4	335.8	1.000	16.34	0.927

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	218.3	174.6	218.3	174.6	186.6	174.6	113.4	2.6	0.	0.
2	223.3	181.4	223.3	181.4	193.7	181.4	111.0	1.6	0.	0.
3	229.1	187.4	229.1	187.4	199.8	187.4	112.1	-2.9	0.	0.
4	225.0	182.5	225.0	182.5	191.9	182.5	117.4	-2.0	0.	0.
5	217.5	173.6	217.5	173.6	180.0	173.6	122.1	-1.5	0.	0.
6	211.6	165.2	211.6	165.2	169.8	165.2	126.2	-4.8	0.	0.
7	219.3	168.2	219.3	168.2	173.1	168.2	134.5	-3.7	0.	0.
8	260.3	202.9	260.3	202.9	203.7	202.9	162.0	2.0	0.	0.
9	274.3	216.7	274.3	216.7	206.7	216.7	180.4	3.3	0.	0.
10	285.9	214.4	285.9	214.4	197.1	214.4	207.0	5.8	0.	0.
11	290.9	199.3	290.9	199.3	192.1	199.3	218.4	-1.4	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.616	0.486	0.616	0.486	0.526	0.486	0.936	0.616
2	0.633	0.508	0.633	0.508	0.549	0.508	0.936	0.633
3	0.654	0.528	0.654	0.528	0.570	0.528	0.938	0.654
4	0.642	0.513	0.642	0.513	0.547	0.513	0.951	0.642
5	0.619	0.487	0.619	0.487	0.512	0.487	0.964	0.619
6	0.601	0.463	0.601	0.463	0.482	0.463	0.973	0.664
7	0.624	0.471	0.624	0.471	0.493	0.471	0.971	0.697
8	0.751	0.573	0.751	0.573	0.588	0.573	0.996	0.751
9	0.796	0.614	0.796	0.614	0.599	0.614	1.048	0.818
10	0.831	0.605	0.831	0.605	0.573	0.605	1.087	0.993
11	0.847	0.559	0.847	0.559	0.559	0.559	1.037	1.053

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-4.5	-10.5	14.1	0.395	0.	0.062	0.062	0.024	0.024
2	10.00	-5.8	-11.8	11.7	0.371	0.	0.046	0.046	0.017	0.017
3	20.00	-6.3	-12.2	8.5	0.360	0.	0.040	0.040	0.014	0.014
4	30.00	-4.4	-10.3	8.0	0.367	0.	0.043	0.043	0.015	0.015
5	36.00	-2.2	-8.0	7.8	0.386	0.	0.047	0.047	0.015	0.015
6	42.00	-0.5	-6.2	6.5	0.412	0.	0.057	0.057	0.018	0.018
7	50.00	-0.4	-6.1	6.7	0.420	0.	0.076	0.076	0.023	0.023
8	70.00	-3.2	-8.7	8.9	0.378	0.	0.071	0.071	0.018	0.018
9	80.00	-3.1	-8.4	9.9	0.363	0.	0.054	0.054	0.013	0.013
10	90.00	-0.7	-5.9	12.5	0.402	0.	0.098	0.098	0.022	0.022
11	95.00	-0.0	-5.1	12.1	0.471	0.	0.195	0.195	0.041	0.041

TABLE VII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

FIRST-STAGE STATOR

(e) 80 Percent of design speed; reading 65

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.757	23.762	37.0	1.2	37.0	1.2	321.7	1.000	13.38	0.990
2	23.167	23.200	34.2	1.0	34.2	1.0	320.2	1.000	13.53	0.989
3	21.981	22.068	32.1	-1.8	32.1	-1.8	317.4	1.000	13.56	0.992
4	20.787	20.927	33.8	-2.5	33.8	-2.5	316.7	1.000	13.51	0.994
5	20.071	20.244	36.3	-1.0	36.3	-1.0	317.3	1.000	13.49	0.995
6	19.350	19.558	38.6	-0.1	38.6	-0.1	318.0	1.000	13.47	0.993
7	18.387	18.649	40.4	0.1	40.4	0.1	318.2	1.000	13.51	0.991
8	15.961	16.388	41.5	-0.7	41.5	-0.7	317.1	1.000	13.81	0.991
9	14.732	15.263	43.5	-0.2	43.5	-0.2	317.5	1.000	14.00	0.987
10	13.492	14.143	48.9	2.7	48.9	2.7	319.8	1.000	14.29	0.971
11	12.868	13.586	51.5	-1.1	51.5	-1.1	320.0	1.000	14.23	0.943

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	166.4	131.3	166.4	131.3	137.9	131.3	100.1	2.7	0.	0.
2	172.8	137.8	172.8	137.8	142.9	137.7	97.2	2.4	0.	0.
3	176.5	142.4	176.5	142.4	149.5	142.4	93.8	-4.4	0.	0.
4	175.9	142.6	175.9	142.6	146.1	142.4	97.9	-6.3	0.	0.
5	176.6	142.3	176.6	142.3	142.3	142.3	104.6	-2.4	0.	0.
6	178.1	141.7	178.1	141.7	139.2	141.7	111.1	-0.2	0.	0.
7	182.6	142.7	182.6	142.7	139.2	142.7	118.3	0.2	0.	0.
8	200.3	152.2	200.3	152.2	149.9	152.2	132.8	-1.9	0.	0.
9	213.4	161.4	213.4	161.4	154.7	161.4	147.0	-0.4	0.	0.
10	230.2	161.6	230.2	161.6	151.4	161.4	173.4	7.5	0.	0.
11	234.3	143.5	234.3	143.5	146.0	143.5	183.3	-2.9	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.473	0.370	0.473	0.370	0.378	0.370	0.988	0.604
2	0.493	0.390	0.493	0.390	0.408	0.390	0.964	0.563
3	0.507	0.405	0.507	0.405	0.429	0.405	0.952	0.507
4	0.505	0.406	0.505	0.406	0.420	0.406	0.975	0.525
5	0.507	0.405	0.507	0.405	0.409	0.405	1.000	0.581
6	0.511	0.403	0.511	0.403	0.399	0.403	1.018	0.620
7	0.525	0.406	0.525	0.406	0.400	0.406	1.026	0.654
8	0.580	0.434	0.580	0.434	0.434	0.434	1.016	0.684
9	0.620	0.461	0.620	0.461	0.449	0.461	1.043	0.734
10	0.670	0.460	0.670	0.460	0.441	0.460	1.066	0.878
11	0.683	0.407	0.683	0.407	0.426	0.407	0.983	0.932

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	1.7	-4.3	15.0	0.435	0.	0.072	0.072	0.028	0.028
2	10.00	-0.9	-6.8	12.8	0.408	0.	0.073	0.073	0.027	0.027
3	20.00	-3.0	-8.9	8.2	0.390	0.	0.048	0.048	0.017	0.017
4	30.00	-1.5	-7.4	6.7	0.388	0.	0.037	0.037	0.012	0.012
5	36.00	0.5	-5.3	7.9	0.390	0.	0.033	0.033	0.011	0.011
6	42.00	2.0	-3.7	8.6	0.399	0.	0.042	0.042	0.013	0.013
7	50.00	2.7	-3.0	8.6	0.410	0.	0.053	0.053	0.016	0.016
8	70.00	0.3	-5.1	8.1	0.413	0.	0.044	0.044	0.011	0.011
9	80.00	-0.2	-5.5	9.5	0.407	0.	0.059	0.059	0.014	0.014
10	90.00	2.3	-2.9	14.2	0.454	0.	0.110	0.110	0.024	0.024
11	95.00	3.3	-1.7	11.9	0.551	0.	0.211	0.211	0.045	0.045

TABLE VII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

FIRST-STAGE STATOR

(f) 80 Percent of design speed; reading 76

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.757	23.762	42.5	2.0	42.5	2.0	326.0	1.000	13.86	0.988
2	23.167	23.200	41.9	1.9	41.9	1.9	324.8	1.000	13.86	0.990
3	21.981	22.068	40.5	0.3	40.5	0.3	322.0	1.000	13.84	0.988
4	20.787	20.927	42.5	0.5	42.5	0.5	321.2	1.000	13.77	0.988
5	20.071	20.244	44.6	1.1	44.6	1.1	321.2	1.000	13.67	0.989
6	19.350	19.558	46.2	0.5	46.2	0.5	321.5	1.000	13.69	0.985
7	18.387	18.649	47.4	1.3	47.4	1.3	321.4	1.000	13.73	0.985
8	15.961	16.388	45.8	1.2	45.8	1.2	318.7	1.000	13.84	0.988
9	14.732	15.263	46.6	2.5	46.6	2.5	318.5	1.000	14.10	0.980
10	13.492	14.143	51.2	6.1	51.2	6.1	319.7	1.000	14.21	0.962
11	12.868	13.586	54.7	0.1	54.7	0.1	320.0	1.000	14.09	0.951

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	167.4	127.3	167.4	127.3	123.4	127.2	113.1	4.5	0.	0.
2	168.8	128.7	168.8	128.7	125.6	128.7	112.8	4.2	0.	0.
3	169.6	127.8	169.6	127.8	128.9	127.8	110.2	0.7	0.	0.
4	169.2	123.8	169.2	123.8	124.7	123.7	114.3	1.1	0.	0.
5	168.5	120.7	168.5	120.7	119.9	120.7	118.4	2.3	0.	0.
6	171.4	119.3	171.4	119.3	118.6	119.3	123.8	1.1	0.	0.
7	177.6	121.1	177.6	121.1	120.2	121.0	130.8	2.8	0.	0.
8	194.1	133.0	194.1	133.0	135.3	133.0	139.2	2.8	0.	0.
9	209.2	139.4	209.2	139.4	143.8	139.3	151.9	6.1	0.	0.
10	221.9	135.5	221.9	135.5	139.1	134.7	172.9	14.4	0.	0.
11	224.9	122.4	224.9	122.4	129.9	122.4	183.6	0.3	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.473	0.356	0.473	0.356	0.349	0.356	1.031	0.695
2	0.478	0.361	0.478	0.361	0.355	0.361	1.024	0.684
3	0.482	0.360	0.482	0.360	0.367	0.360	0.991	0.654
4	0.482	0.349	0.482	0.349	0.355	0.349	0.992	0.674
5	0.480	0.340	0.480	0.340	0.341	0.340	1.007	0.698
6	0.488	0.336	0.488	0.336	0.338	0.336	1.006	0.726
7	0.507	0.341	0.507	0.341	0.343	0.341	1.007	0.758
8	0.559	0.377	0.559	0.377	0.390	0.377	0.983	0.750
9	0.606	0.396	0.606	0.396	0.417	0.395	0.969	0.788
10	0.644	0.384	0.644	0.384	0.404	0.381	0.968	0.896
11	0.653	0.345	0.653	0.345	0.377	0.345	0.942	0.965

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	7.2	1.2	15.8	0.488	0.	0.083	0.083	0.032	0.032
2	10.00	6.8	0.9	13.6	0.478	0.	0.070	0.070	0.026	0.026
3	20.00	5.5	-0.5	10.2	0.475	0.	0.078	0.078	0.028	0.028
4	30.00	7.1	1.3	9.7	0.493	0.	0.081	0.081	0.027	0.027
5	36.00	8.8	3.0	10.0	0.506	0.	0.073	0.073	0.024	0.024
6	42.00	9.6	3.9	9.2	0.527	0.	0.100	0.100	0.031	0.031
7	50.00	9.7	4.0	9.9	0.532	0.	0.091	0.091	0.027	0.027
8	70.00	4.6	-0.9	10.1	0.495	0.	0.063	0.063	0.016	0.016
9	80.00	2.9	-2.4	12.1	0.498	0.	0.089	0.089	0.021	0.021
10	90.00	4.5	-0.6	17.6	0.543	0.	0.156	0.156	0.034	0.034
11	95.00	6.5	1.5	13.2	0.624	0.	0.197	0.197	0.042	0.042

TABLE VII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR FIRST-STAGE STATOR

(g) 80 Percent of design speed; reading 87

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.757	23.762	39.6	1.4	39.6	1.4	324.5	1.000	13.67	0.989
2	23.167	23.200	38.2	1.5	38.2	1.5	322.8	1.000	13.70	0.991
3	21.981	22.068	36.2	-1.4	36.2	-1.4	319.5	1.000	13.71	0.992
4	20.787	20.927	37.9	-1.7	37.9	-1.7	318.9	1.000	13.63	0.994
5	20.071	20.244	40.2	-0.1	40.2	-0.1	319.5	1.000	13.63	0.993
6	19.350	19.558	42.2	0.4	42.2	0.4	319.9	1.000	13.62	0.989
7	18.387	18.649	43.9	1.1	43.9	1.1	320.1	1.000	13.65	0.988
8	15.961	16.388	44.0	-0.3	44.0	-0.3	317.9	1.000	13.82	0.991
9	14.732	15.263	45.4	0.9	45.4	0.9	318.1	1.000	14.02	0.987
10	13.492	14.143	50.4	4.4	50.4	4.4	319.6	1.000	14.26	0.966
11	12.868	13.586	54.0	-0.3	54.0	-0.3	320.0	1.000	14.07	0.951

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	169.1	129.9	169.1	129.9	130.3	129.9	107.7	3.1	0.	0.
2	171.0	132.8	171.0	132.8	134.5	132.8	105.7	3.4	0.	0.
3	171.8	134.5	171.8	134.5	138.7	134.5	101.4	-3.2	0.	0.
4	172.1	133.3	172.1	133.3	135.7	133.3	105.8	-3.9	0.	0.
5	173.6	132.1	173.6	132.1	132.5	132.1	112.1	-0.2	0.	0.
6	175.9	130.8	175.9	130.8	130.3	130.7	118.2	0.8	0.	0.
7	180.9	131.6	180.9	131.6	130.4	131.6	125.5	2.5	0.	0.
8	195.8	141.9	195.8	141.9	140.8	141.9	135.9	-0.8	0.	0.
9	210.0	149.5	210.0	149.5	147.4	149.5	149.6	2.3	0.	0.
10	224.4	146.6	224.4	146.6	143.1	146.1	172.8	11.2	0.	0.
11	225.7	128.6	225.7	128.6	132.8	128.6	182.5	-0.8	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.479	0.365	0.479	0.365	0.369	0.364	0.996	0.655
2	0.486	0.374	0.486	0.374	0.382	0.374	0.987	0.631
3	0.491	0.381	0.491	0.381	0.396	0.381	0.969	0.585
4	0.492	0.378	0.492	0.378	0.388	0.378	0.982	0.608
5	0.496	0.374	0.496	0.374	0.379	0.374	0.997	0.646
6	0.503	0.370	0.503	0.370	0.372	0.370	1.003	0.678
7	0.518	0.372	0.518	0.372	0.373	0.372	1.009	0.712
8	0.565	0.403	0.565	0.403	0.406	0.403	1.007	0.720
9	0.609	0.426	0.609	0.426	0.427	0.426	1.014	0.766
10	0.652	0.416	0.652	0.416	0.416	0.415	1.021	0.889
11	0.656	0.363	0.656	0.363	0.386	0.363	0.968	0.952

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	4.3	-1.7	15.2	0.469	0.	0.079	0.079	0.030	0.030
2	10.00	3.1	-2.9	13.2	0.447	0.	0.061	0.061	0.023	0.023
3	20.00	1.1	-4.8	8.5	0.433	0.	0.050	0.050	0.018	0.018
4	30.00	2.6	-3.3	7.5	0.439	0.	0.037	0.037	0.012	0.012
5	36.00	4.4	-1.4	8.8	0.448	0.	0.048	0.048	0.015	0.015
6	42.00	5.6	-0.1	9.0	0.465	0.	0.070	0.070	0.022	0.022
7	50.00	6.2	0.5	9.6	0.474	0.	0.070	0.070	0.021	0.021
8	70.00	2.8	-2.7	8.5	0.455	0.	0.045	0.045	0.012	0.012
9	80.00	1.7	-3.6	10.5	0.454	0.	0.060	0.060	0.015	0.015
10	90.00	3.8	-1.4	15.9	0.502	0.	0.137	0.137	[illegible]	0.030
11	95.00	5.8	0.7	12.7	0.598	0.	0.197	0.197	0.042	0.042

TABLE VII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

FIRST-STAGE STATOR

(h) 80 Percent of design speed; reading 98

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.757	23.762	33.0	0.1	33.0	0.1	319.1	1.000	13.09	0.989
2	23.167	23.200	30.5	-0.5	30.5	-0.5	317.3	1.000	13.24	0.990
3	21.981	22.068	28.8	-2.9	28.8	-2.9	315.1	1.000	13.30	0.994
4	20.787	20.927	30.4	-2.8	30.4	-2.8	315.1	1.000	13.33	0.994
5	20.071	20.244	32.9	-1.5	32.9	-1.5	315.6	1.000	13.30	0.995
6	19.350	19.558	35.4	-0.6	35.4	-0.6	316.3	1.000	13.27	0.995
7	18.387	18.649	37.3	-0.5	37.3	-0.5	316.7	1.000	13.31	0.993
8	15.961	16.388	39.3	-1.0	39.3	-1.0	316.2	1.000	13.71	0.992
9	14.732	15.263	42.1	-0.7	42.1	-0.7	317.0	1.000	13.90	0.990
10	13.492	14.143	47.7	1.5	47.7	1.5	319.4	1.000	14.20	0.978
11	12.868	13.586	49.8	-1.2	49.8	-1.2	319.8	1.000	14.22	0.944

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	167.7	134.3	167.7	134.3	140.6	134.3	91.3	0.3	0.	0.
2	173.6	141.5	173.6	141.5	149.6	141.5	88.1	-1.1	0.	0.
3	178.7	148.4	178.7	148.4	156.5	148.2	86.1	-7.5	0.	0.
4	179.4	149.9	179.4	149.9	154.8	149.7	90.7	-7.5	0.	0.
5	179.5	149.5	179.5	149.5	150.8	149.4	97.4	-3.9	0.	0.
6	180.2	149.1	180.2	149.1	146.8	149.1	104.4	-1.5	0.	0.
7	184.5	150.8	184.5	150.8	146.8	150.8	111.8	-1.2	0.	0.
8	202.8	161.9	202.8	161.9	157.0	161.9	128.4	-2.7	0.	0.
9	215.3	172.4	215.3	172.4	159.8	172.4	144.3	-2.0	0.	0.
10	232.7	175.3	232.7	175.3	156.6	175.2	172.2	4.5	0.	0.
11	238.5	159.9	238.5	159.9	153.8	159.9	182.3	-3.4	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.479	0.380	0.479	0.380	0.402	0.380	0.955	0.531
2	0.498	0.403	0.498	0.403	0.429	0.403	0.946	0.498
3	0.515	0.425	0.515	0.425	0.451	0.424	0.947	0.515
4	0.518	0.429	0.518	0.429	0.446	0.428	0.967	0.518
5	0.517	0.427	0.517	0.427	0.435	0.427	0.991	0.517
6	0.519	0.426	0.519	0.426	0.423	0.426	1.016	0.554
7	0.531	0.431	0.531	0.431	0.423	0.431	1.028	0.593
8	0.588	0.464	0.588	0.464	0.455	0.464	1.031	0.629
9	0.626	0.495	0.626	0.495	0.465	0.495	1.079	0.701
10	0.679	0.501	0.679	0.501	0.457	0.501	1.119	0.860
11	0.697	0.455	0.697	0.455	0.449	0.455	1.040	0.910

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-2.3	-8.3	13.9	0.407	0.	0.073	0.073	0.028	0.028
2	10.00	-4.6	-10.6	11.3	0.377	0.	0.063	0.063	0.023	0.023
3	20.00	-6.3	-12.2	7.0	0.355	0.	0.034	0.034	0.012	0.012
4	30.00	-5.0	-10.8	6.3	0.348	0.	0.034	0.034	0.011	0.011
5	36.00	-2.9	-8.7	7.4	0.350	0.	0.032	0.032	0.010	0.010
6	42.00	-1.1	-6.9	8.1	0.356	0.	0.031	0.031	0.010	0.010
7	50.00	-0.4	-6.1	8.0	0.364	0.	0.041	0.041	0.012	0.012
8	70.00	-1.9	-7.4	7.9	0.368	0.	0.040	0.040	0.010	0.010
9	80.00	-1.6	-6.9	8.9	0.360	0.	0.045	0.045	0.011	0.011
10	90.00	1.1	-4.1	13.0	0.403	0.	0.084	0.084	0.019	0.019
11	95.00	1.7	-3.4	11.8	0.490	0.	0.201	0.201	0.043	0.043

TABLE VII. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES FOR

FIRST-STAGE STATOR

(i) 80 Percent of design speed; reading 109

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.757	23.762	31.1	-0.6	31.1	-0.6	317.8	1.000	12.92	0.990
2	23.167	23.200	28.8	-0.9	28.8	-0.9	316.3	1.000	13.09	0.992
3	21.981	22.068	27.4	-3.1	27.4	-3.1	314.4	1.000	13.18	0.995
4	20.787	20.927	28.9	-2.8	28.9	-2.8	314.4	1.000	13.23	0.995
5	20.071	20.244	31.0	-1.7	31.0	-1.7	314.9	1.000	13.23	0.993
6	19.350	19.558	33.7	-1.2	33.7	-1.2	315.8	1.000	13.17	0.994
7	18.387	18.649	36.0	-0.5	36.0	-0.5	316.2	1.000	13.20	0.994
8	15.961	16.388	38.0	-0.9	38.0	-0.9	316.0	1.000	13.74	0.990
9	14.732	15.263	41.0	-0.8	41.0	-0.8	317.0	1.000	13.94	0.988
10	13.492	14.143	46.5	0.9	46.5	0.9	319.4	1.000	14.26	0.976
11	12.868	13.586	49.0	-1.1	49.0	-1.1	319.9	1.000	14.26	0.944

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	167.7	135.4	167.7	135.4	143.6	135.4	66.7	-1.4	0.	0.
2	174.6	144.4	174.6	144.4	153.0	144.4	84.2	-2.3	0.	0.
3	180.4	152.3	180.4	152.3	160.2	152.1	83.0	-8.3	0.	0.
4	182.6	154.5	182.6	154.5	159.8	154.3	88.3	-7.6	0.	0.
5	183.3	154.2	183.3	154.2	157.1	154.1	94.4	-4.6	0.	0.
6	182.9	153.2	182.9	153.2	152.1	153.2	101.5	-3.1	0.	0.
7	186.6	155.3	186.6	155.3	150.9	155.3	109.7	-1.3	0.	0.
8	206.2	169.2	206.2	169.2	162.5	169.2	126.9	-2.7	0.	0.
9	219.5	180.4	219.5	180.4	165.7	180.4	144.0	-2.4	0.	0.
10	236.0	184.5	236.0	184.5	162.3	184.5	171.3	3.0	0.	0.
11	241.2	170.6	241.2	170.6	158.4	170.6	181.9	-3.3	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.480	0.384	0.480	0.384	0.411	0.384	0.943	0.480
2	0.502	0.412	0.502	0.412	0.440	0.412	0.943	0.502
3	0.521	0.437	0.521	0.437	0.463	0.436	0.949	0.521
4	0.528	0.443	0.528	0.443	0.462	0.442	0.965	0.528
5	0.529	0.442	0.529	0.442	0.454	0.442	0.981	0.529
6	0.527	0.438	0.527	0.438	0.439	0.438	1.007	0.527
7	0.538	0.444	0.538	0.444	0.435	0.444	1.029	0.560
8	0.599	0.486	0.599	0.486	0.472	0.486	1.041	0.599
9	0.640	0.519	0.640	0.519	0.483	0.519	1.089	0.678
10	0.689	0.529	0.689	0.529	0.474	0.529	1.136	0.842
11	0.705	0.487	0.705	0.487	0.463	0.487	1.077	0.899

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-4.2	-10.1	13.2	0.394	0.	0.068	0.068	0.026	0.026
2	10.00	-6.3	-12.2	10.8	0.358	0.	0.052	0.052	0.019	0.019
3	20.00	-7.7	-13.6	6.8	0.335	0.	0.032	0.032	0.012	0.012
4	30.00	-6.4	-12.3	6.4	0.330	0.	0.030	0.030	0.010	0.010
5	36.00	-4.8	-10.6	7.1	0.334	0.	0.041	0.041	0.013	0.013
6	42.00	-2.9	-8.6	7.5	0.341	0.	0.035	0.035	0.011	0.011
7	50.00	-1.7	-7.4	8.0	0.344	0.	0.035	0.035	0.010	0.010
8	70.00	-3.2	-8.7	7.9	0.341	0.	0.046	0.046	0.012	0.012
9	80.00	-2.7	-8.0	8.8	0.336	0.	0.050	0.050	0.012	0.012
10	90.00	-0.1	-5.2	12.5	0.372	0.	0.087	0.087	0.019	0.019
11	95.00	0.8	-4.3	12.0	0.451	0.	0.198	0.198	0.042	0.042

TABLE VIII. - BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE ROTOR

(a) 100 Percent of design speed; reading 16

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	23.533	23.188	2.3	44.4	64.4	55.3	343.6	1.168	15.43	1.560
2	23.002	22.708	1.9	44.4	62.7	54.3	341.2	1.167	15.63	1.544
3	21.951	21.742	0.5	43.3	61.1	52.3	337.8	1.162	15.71	1.537
4	20.899	20.780	0.8	43.5	60.5	49.8	336.1	1.157	15.57	1.543
5	20.272	20.206	0.9	43.7	61.0	48.1	335.7	1.154	15.29	1.568
6	19.647	19.637	-0.6	43.0	61.9	46.7	334.9	1.152	15.01	1.590
7	18.814	18.887	-0.9	42.6	61.0	43.7	334.7	1.148	15.03	1.586
8	16.721	17.071	0.8	44.0	55.2	34.1	333.4	1.140	15.88	1.515
9	15.651	16.198	0.9	46.8	53.3	27.9	333.0	1.143	15.97	1.498
10	14.536	15.352	3.8	49.2	53.3	19.5	335.1	1.141	15.75	1.510
11	13.952	14.938	0.1	47.5	58.0	18.0	335.9	1.142	15.18	1.545

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	185.9	225.1	43[illegible]	282.5	185.7	161.0	7.5	157.4	395.4	389.6
2	195.9	225.2	427.3	275.6	195.8	160.8	6.5	157.6	386.3	381.4
3	202.7	224.5	419.4	267.4	202.7	163.4	1.9	153.9	369.1	365.6
4	197.0	225.4	399.8	253.2	197.0	163.4	2.7	155.2	350.6	348.6
5	187.0	226.5	385.6	245.1	187.0	163.6	3.0	156.6	340.2	339.1
6	176.7	226.1	375.5	240.8	176.7	165.3	-1.8	154.3	329.6	329.4
7	176.2	229.1	363.4	233.4	176.1	168.6	-2.7	155.1	315.3	316.5
8	192.3	240.8	336.5	209.2	192.2	173.1	2.8	167.4	278.9	284.8
9	192.7	247.8	322.2	192.1	192.7	169.8	3.1	180.5	261.3	270.5
10	172.7	259.4	288.4	179.9	172.3	169.6	11.5	196.3	242.8	256.4
11	145.3	260.4	274.0	185.1	145.3	176.0	0.3	191.9	232.7	249.1

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.513	0.579	1.188	0.727	0.513	0.414	0.867	1.363
2	0.544	0.582	1.188	0.712	0.544	0.416	0.822	1.327
3	0.568	0.584	1.175	0.696	0.568	0.425	0.806	1.316
4	0.552	0.590	1.121	0.663	0.552	0.428	0.830	1.310
5	0.523	0.594	1.078	0.643	0.523	0.429	0.875	1.334
6	0.493	0.594	1.048	0.633	0.493	0.434	0.935	1.384
7	0.492	0.604	1.015	0.616	0.492	0.445	0.957	1.383
8	0.540	0.641	0.946	0.557	0.540	0.461	0.901	1.216
9	0.542	0.661	0.906	0.512	0.542	0.453	0.881	1.157
10	0.482	0.693	0.804	0.481	0.480	0.453	0.984	1.075
11	0.402	0.695	0.758	0.494	0.402	0.470	1.212	1.152

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	2.5	-0.0	1.0	0.474	0.807	0.159	0.130	0.034	0.028
2	10.00	1.7	-0.8	0.7	0.485	0.790	0.171	0.147	0.037	0.032
3	20.00	1.7	-1.0	1.0	0.490	0.803	0.160	0.139	0.035	0.030
4	30.00	2.8	-0.3	1.1	0.495	0.842	0.134	0.118	0.029	0.026
5	36.00	4.4	1.0	1.3	0.495	0.892	0.095	0.080	0.021	0.018
6	42.00	6.4	2.7	2.1	0.491	0.931	0.063	0.046	0.014	0.010
7	50.00	6.9	2.7	2.6	0.491	0.952	0.045	0.030	0.010	0.007
8	70.00	3.8	-1.4	4.2	0.514	0.899	0.100	0.098	0.023	0.022
9	80.00	2.6	-2.9	5.8	0.548	0.852	0.158	0.158	0.036	0.036
10	90.00	1.8	-3.5	7.8	0.535	0.885	0.147	0.147	0.033	0.033
11	95.00	5.1	0.2	12.8	0.492	0.933	0.094	0.094	0.021	0.021

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE ROTOR

(b) 100 Percent of design speed; reading 27

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.533	23.188	2.3	45.3	64.6	55.6	345.7	1.170	15.66	1.567
2	23.002	22.708	2.0	44.9	63.0	54.2	343.5	1.169	15.82	1.560
3	21.951	21.742	1.0	44.1	61.4	52.2	339.7	1.164	15.90	1.543
4	20.899	20.780	1.1	44.5	60.8	50.0	337.7	1.159	15.78	1.555
5	20.272	20.206	1.1	44.8	61.2	48.6	337.2	1.155	15.52	1.567
6	19.647	19.637	-0.4	44.0	62.2	47.3	336.6	1.153	15.24	1.590
7	18.814	18.887	-0.7	43.6	61.5	44.0	335.8	1.150	15.23	1.594
8	16.721	17.071	0.9	45.1	56.1	34.3	333.9	1.144	15.97	1.516
9	15.651	16.198	1.3	47.7	54.1	27.5	334.0	1.146	16.07	1.510
10	14.536	15.352	4.4	50.5	54.3	18.7	335.8	1.145	15.77	1.523
11	13.952	14.938	0.4	48.7	58.9	17.5	336.7	1.145	15.25	1.548

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	185.2	224.6	430.9	280.0	185.0	158.0	7.4	159.5	396.5	39[illegible].7
2	193.6	226.1	426.4	273.8	193.4	160.1	6.8	159.7	386.8	381.9
3	199.8	225.8	416.8	264.4	199.7	162.1	3.7	157.1	369.5	366.0
4	194.8	225.7	399.0	250.2	194.8	160.9	3.6	158.3	351.8	349.8
5	185.3	225.0	384.5	241.4	185.3	159.7	3.7	158.5	340.6	339.5
6	175.1	224.7	375.8	238.3	175.1	161.7	-1.3	156.0	331.2	331.0
7	173.3	228.7	362.7	230.2	173.3	165.6	-2.1	157.8	316.5	317.7
8	187.5	241.5	336.0	206.3	187.5	170.4	2.9	171.2	281.6	287.5
9	187.6	250.1	319.8	189.8	187.5	168.4	4.2	184.9	263.3	272.5
10	166.9	262.0	285.5	176.1	166.4	166.8	12.8	202.1	244.8	258.5
11	140.9	261.9	272.9	181.3	140.9	172.9	1.1	196.8	234.8	251.4

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.510	0.575	1.186	0.718	0.509	0.405	0.854	1.367
2	0.536	0.582	1.180	0.705	0.535	0.412	0.827	1.331
3	0.557	0.586	1.163	0.686	0.557	0.421	0.812	1.316
4	0.544	0.589	1.115	0.653	0.544	0.420	0.826	1.316
5	0.517	0.589	1.072	0.631	0.517	0.418	0.862	1.338
6	0.487	0.589	1.046	0.624	0.487	0.424	0.923	1.393
7	0.483	0.601	1.010	0.605	0.483	0.435	0.956	1.398
8	0.526	0.642	0.942	0.548	0.526	0.453	0.909	1.243
9	0.526	0.666	0.897	0.505	0.526	0.448	0.898	1.173
10	0.464	0.699	0.794	0.470	0.463	0.445	1.002	1.090
11	0.389	0.697	0.753	0.483	0.389	0.460	1.227	1.169

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	2.7	0.2	1.3	0.483	0.804	0.163	0.134	0.035	0.029
2	10.00	2.0	-0.5	0.7	0.490	0.802	0.165	0.141	0.036	0.030
3	20.00	1.9	-0.7	0.8	0.495	0.804	0.163	0.143	0.035	0.031
4	30.00	3.1	0.0	1.3	0.504	0.845	0.133	0.117	0.029	0.025
5	36.00	4.6	1.2	1.8	0.504	0.883	0.104	0.089	0.023	0.019
6	42.00	6.7	3.0	2.7	0.499	0.925	0.069	0.051	0.015	0.011
7	50.00	7.3	3.2	2.9	0.500	0.949	0.049	0.033	0.011	0.007
8	70.00	4.8	-0.4	4.4	0.524	0.878	0.123	0.121	0.028	0.027
9	80.00	3.4	-2.0	5.3	0.554	0.852	0.162	0.162	0.037	0.037
10	90.00	2.8	-2.4	7.0	0.547	0.880	0.159	0.159	0.036	0.036
11	95.00	6.1	1.1	12.3	0.507	0.916	0.122	0.122	0.027	0.027

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE ROTOR

(c) 100 Percent of design speed; reading 38

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	23.533	23.188	1.1	42.4	64.3	56.5	338.2	1.163	14.77	1.532
2	23.002	22.708	0.7	42.1	62.5	54.9	336.0	1.164	15.00	1.524
3	21.951	21.742	-0.3	40.6	60.5	52.9	333.2	1.158	15.18	1.506
4	20.899	20.780	-0.1	40.4	59.9	50.6	332.6	1.150	14.99	1.522
5	20.272	20.206	0.0	40.9	60.6	49.0	332.6	1.148	14.68	1.553
6	19.647	19.637	-1.3	40.6	61.5	47.3	332.0	1.148	14.38	1.581
7	18.814	18.887	-1.3	40.2	60.3	43.8	332.2	1.145	14.45	1.588
8	16.721	17.071	0.6	40.6	52.6	33.4	332.9	1.137	15.81	1.489
9	15.651	16.198	0.8	42.2	49.9	27.0	333.5	1.139	16.10	1.465
10	14.536	15.352	1.8	43.3	50.4	19.9	335.5	1.138	15.82	1.488
11	13.952	14.938	-0.6	41.7	54.2	17.6	336.1	1.138	15.20	1.541

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	189.0	217.7	435.1	291.5	189.0	160.8	3.8	146.7	395.7	389.8
2	200.5	221.4	433.6	285.5	200.5	164.1	2.6	148.5	387.1	382.1
3	210.0	221.3	426.0	278.5	210.0	168.1	-1.2	143.9	369.4	365.9
4	203.8	221.5	406.4	266.0	203.8	168.7	-0.4	143.6	351.2	349.2
5	192.4	223.2	392.0	257.2	192.4	168.6	0.1	146.2	341.6	340.4
6	181.4	224.0	380.5	251.1	181.4	170.2	-4.1	145.6	330.4	330.3
7	183.1	230.3	369.0	244.0	183.1	176.0	-4.1	148.5	316.2	317.5
8	213.7	249.6	351.7	227.2	213.7	189.7	2.1	162.3	281.4	287.3
9	218.7	259.3	339.6	215.4	218.7	192.0	3.0	174.3	262.9	272.0
10	197.2	271.9	309.1	210.6	197.1	198.0	6.2	186.3	244.3	258.0
11	170.0	277.7	290.8	217.4	170.0	207.2	-1.7	184.9	234.2	250.8

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.527	0.565	1.213	0.757	0.527	0.417	0.851	1.379
2	0.563	0.577	1.217	0.744	0.562	0.428	0.819	1.343
3	0.594	0.581	1.205	0.731	0.594	0.441	0.801	1.319
4	0.576	0.584	1.148	0.701	0.576	0.445	0.828	1.311
5	0.542	0.589	1.103	0.679	0.542	0.445	0.876	1.337
6	0.509	0.592	1.068	0.664	0.509	0.450	0.938	1.381
7	0.514	0.611	1.036	0.647	0.514	0.467	0.961	1.365
8	0.605	0.668	0.996	0.608	0.605	0.508	0.888	1.181
9	0.620	0.695	0.963	0.578	0.620	0.515	0.878	1.100
10	0.553	0.731	0.867	0.566	0.553	0.532	1.005	1.065
11	0.473	0.747	0.809	0.585	0.473	0.557	1.219	1.125

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	2.3	-0.2	2.2	0.453	0.793	0.162	0.129	0.034	0.027
2	10.00	1.4	-1.1	1.3	0.465	0.777	0.175	0.146	0.037	0.031
3	20.00	1.0	-1.7	1.5	0.466	0.785	0.166	0.141	0.036	0.030
4	30.00	2.2	-0.8	1.9	0.465	0.848	0.120	0.102	0.026	0.022
5	36.00	4.0	0.6	2.2	0.466	0.904	0.080	0.063	0.017	0.014
6	42.00	6.0	2.3	2.8	0.465	0.945	0.047	0.028	0.010	0.006
7	50.00	6.1	1.9	2.7	0.465	0.975	0.022	0.008	0.005	0.002
8	70.00	1.3	-3.9	3.5	0.480	0.878	0.110	0.108	0.025	0.025
9	80.00	-0.8	-6.2	4.8	0.498	0.829	0.162	0.162	0.037	0.037
10	90.00	-1.2	-6.4	8.2	0.463	0.872	0.142	0.142	0.032	0.032
11	95.00	1.4	-3.6	12.4	0.406	0.951	0.062	0.062	0.014	0.014

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE ROTOR

(d) 100 Percent of design speed; reading 49

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.533	23.188	0.8	35.3	64.1	58.5	336.2	1.132	14.54	1.371
2	23.002	22.708	0.5	34.1	62.4	56.1	334.1	1.133	14.75	1.385
3	21.951	21.742	-0.8	31.9	60.3	53.4	331.5	1.129	14.93	1.388
4	20.899	20.780	-0.6	32.2	59.7	51.6	330.9	1.123	14.78	1.401
5	20.272	20.206	-0.4	33.1	60.3	50.3	330.9	1.123	14.47	1.429
6	19.647	19.637	-1.5	35.2	61.2	49.1	330.6	1.123	14.18	1.454
7	18.814	18.887	-1.1	34.0	59.7	46.5	331.3	1.121	14.26	1.446
8	16.721	17.071	0.5	36.0	51.7	35.4	332.4	1.122	15.72	1.364
9	15.651	16.198	0.8	37.5	48.9	27.4	333.3	1.129	16.07	1.384
10	14.536	15.352	1.6	38.9	49.4	18.6	335.4	1.135	15.78	1.443
11	13.952	14.938	-0.4	37.5	53.1	16.4	335.8	1.135	15.15	1.501

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	190.4	204.0	436.5	318.7	190.4	166.5	2.7	117.9	395.5	389.7
2	201.4	212.9	434.4	315.9	201.4	176.3	1.6	119.4	386.5	381.5
3	211.3	217.9	426.9	310.5	211.3	185.0	-2.9	115.2	368.1	364.6
4	205.9	217.7	408.1	296.6	205.9	184.3	-2.0	116.0	350.4	348.4
5	194.8	218.3	393.4	286.2	194.8	182.9	-1.5	119.1	340.3	339.2
6	184.1	218.0	381.9	278.4	184.1	182.4	-4.7	119.4	329.9	329.7
7	186.7	220.9	369.7	266.4	186.6	183.3	-3.7	123.4	315.5	316.7
8	220.2	246.5	355.3	244.7	220.2	199.4	2.0	144.9	280.9	286.7
9	226.3	266.9	344.4	238.6	226.2	211.9	3.2	162.3	262.8	272.0
10	204.4	289.8	314.2	238.1	204.4	225.6	5.6	181.9	244.4	258.1
11	177.0	297.7	294.4	246.2	177.0	236.3	-1.3	181.1	233.9	250.5

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.532	0.537	1.221	0.838	0.532	0.438	0.875	1.382
2	0.567	0.563	1.223	0.835	0.567	0.466	0.876	1.346
3	0.599	0.581	1.211	0.828	0.599	0.493	0.876	1.320
4	0.584	0.582	1.157	0.793	0.584	0.493	0.895	1.310
5	0.550	0.584	1.111	0.766	0.550	0.489	0.939	1.332
6	0.519	0.584	1.076	0.745	0.518	0.488	0.991	1.373
7	0.526	0.592	1.041	0.714	0.525	0.491	0.982	1.347
8	0.626	0.664	1.010	0.659	0.626	0.537	0.906	1.150
9	0.643	0.721	0.979	0.645	0.643	0.573	0.937	1.071
10	0.575	0.786	0.884	0.646	0.575	0.612	1.104	1.052
11	0.493	0.809	0.821	0.669	0.493	0.642	1.335	1.108

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	2.2	-0.3	4.2	0.369	0.713	0.185	0.150	0.036	0.030
2	10.00	1.3	-1.2	2.5	0.372	0.730	0.176	0.146	0.036	0.030
3	20.00	0.9	-1.8	2.1	0.370	0.761	0.154	0.129	0.033	0.027
4	30.00	2.0	-1.0	2.9	0.371	0.819	0.120	0.100	0.025	0.021
5	36.00	3.7	0.4	3.5	0.373	0.874	0.088	0.070	0.018	0.015
6	42.00	5.7	2.0	4.5	0.375	0.918	0.060	0.041	0.013	0.009
7	50.00	5.[illegible]	[illegible].4	5.4	0.385	0.919	0.061	0.048	0.013	0.010
8	70.00	0.4	-4.8	5.5	0.423	0.756	0.192	0.191	0.043	0.043
9	80.00	-1.[illegible]	-7.2	5.2	0.428	0.753	0.212	0.212	0.049	0.049
10	90.00	-2.1	-7.3	6.9	0.381	0.820	0.189	0.189	0.043	0.043
11	95.00	0.2	-4.8	11.1	0.312	0.909	0.109	0.109	0.024	0.024

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE ROTOR

(e) 80 Percent of design speed; reading 65

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.533	23.188	1.1	35.0	65.8	58.8	321.7	1.088	13.24	1.274
2	23.002	22.708	0.9	34.5	64.0	56.6	320.2	1.089	13.38	1.279
3	21.951	21.742	-1.6	31.7	62.4	54.1	317.4	1.088	13.45	1.283
4	20.899	20.780	-2.3	31.2	61.3	51.9	316.7	1.085	13.43	1.289
5	20.272	20.206	-0.9	32.5	60.3	50.1	317.3	1.083	13.42	1.293
6	19.647	19.637	-0.1	33.5	59.5	48.3	318.0	1.082	13.38	1.300
7	18.814	18.887	0.1	34.6	58.3	44.9	318.2	1.083	13.39	1.307
8	16.721	17.071	-0.6	36.6	54.5	33.4	317.1	1.090	13.68	1.308
9	15.651	16.198	-0.1	38.8	51.8	25.5	317.5	1.095	13.81	1.325
10	14.536	15.352	2.7	40.8	50.6	16.9	319.8	1.094	13.88	1.325
11	13.952	14.938	-1.2	38.8	55.9	15.6	320.0	1.096	13.42	1.367

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	141.6	162.7	345.9	257.6	141.6	133.4	2.7	93.2	318.2	313.6
2	150.6	169.3	343.4	253.3	150.6	139.6	2.5	95.8	311.1	307.1
3	157.4	172.8	339.8	250.7	157.4	147.0	-4.4	90.9	296.8	294.0
4	158.1	174.0	328.6	241.4	158.0	148.9	-6.3	90.1	281.8	280.2
5	157.7	176.3	317.9	232.1	157.7	148.8	-2.4	94.6	273.7	272.8
6	156.7	178.9	309.0	224.1	156.7	149.1	-0.2	98.7	266.1	266.0
7	157.1	183.8	298.8	213.6	157.1	151.2	0.2	104.4	254.3	255.3
8	162.6	205.1	280.1	197.2	162.5	164.6	-1.8	122.3	226.3	231.0
9	166.9	219.2	269.7	189.2	166.9	170.8	-0.4	137.5	211.4	218.8
10	155.4	234.6	244.6	185.7	155.2	177.6	7.3	153.3	196.3	207.4
11	129.7	239.7	231.6	194.1	129.7	187.0	-2.8	150.1	189.0	202.4

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.400	0.442	0.977	0.700	0.400	0.363	0.942	1.268
2	0.427	0.462	0.975	0.691	0.427	0.381	0.927	1.222
3	0.450	0.474	0.971	0.688	0.449	0.403	0.934	1.219
4	0.452	0.479	0.940	0.664	0.452	0.410	0.942	1.198
5	0.451	0.486	0.908	0.639	0.451	0.410	0.943	1.157
6	0.447	0.493	0.881	0.617	0.447	0.411	0.952	1.130
7	0.448	0.506	0.852	0.589	0.448	0.417	0.963	1.093
8	0.465	0.568	0.801	0.546	0.465	0.456	1.013	1.012
9	0.478	0.608	0.772	0.525	0.478	0.474	1.023	0.942
10	0.442	0.652	0.695	0.516	0.441	0.493	1.145	0.860
11	0.367	0.667	0.654	0.540	0.367	0.520	1.442	0.950

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.9	1.4	4.5	0.353	0.817	0.109	0.105	0.021	0.021
2	10.00	2.9	0.4	3.0	0.363	0.819	0.110	0.108	0.022	0.022
3	20.00	3.0	0.3	2.7	0.361	0.840	0.097	0.095	0.020	0.020
4	30.00	3.6	0.5	3.2	0.364	0.883	0.073	0.072	0.015	0.015
5	36.00	3.7	0.3	3.3	0.370	0.918	0.053	0.053	0.011	0.011
6	42.00	4.0	0.3	3.7	0.377	0.947	0.036	0.036	0.008	0.008
7	50.00	4.1	-0.0	3.8	0.392	0.956	0.032	0.032	0.007	0.007
8	70.00	3.2	-2.0	3.5	0.418	0.888	0.094	0.094	0.021	0.021
9	80.00	1.1	-4.4	3.3	0.432	0.885	0.107	0.107	0.025	0.025
10	90.00	-0.9	-6.2	5.2	0.388	0.885	0.127	0.127	0.029	0.029
11	95.00	3.1	-1.9	10.4	0.319	0.974	0.033	0.033	0.007	0.007

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE ROTOR

(f) 80 Percent of design speed; reading 76

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.533	23.188	1.9	40.2	66.5	56.9	326.0	1.102	13.69	1.326
2	23.002	22.708	1.7	40.8	65.5	55.7	324.8	1.103	13.72	1.330
3	21.951	21.742	0.3	41.1	64.7	53.7	322.0	1.104	13.68	1.331
4	20.899	20.780	0.4	42.2	64.2	51.9	321.2	1.101	13.60	1.335
5	20.272	20.206	1.0	42.8	63.9	50.4	321.2	1.098	13.53	1.336
6	19.647	19.637	0.5	42.2	63.6	48.5	321.5	1.096	13.49	1.3[illegible]
7	18.814	18.887	1.2	42.8	62.1	45.3	321.4	1.094	13.53	1.337
8	16.721	17.071	1.1	44.8	57.6	34.4	318.7	1.096	13.67	1.328
9	15.651	16.198	2.4	47.0	55.0	26.3	318.5	1.099	13.82	1.333
10	14.536	15.352	6.2	49.0	54.5	16.0	319.7	1.099	13.67	1.347
11	13.952	14.938	0.1	45.4	59.4	15.6	320.0	1.099	13.40	1.365

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	137.2	173.1	343.4	242.2	137.1	132.2	4.5	111.7	319.4	314.7
2	140.4	174.9	338.4	234.8	140.3	132.4	4.3	114.3	312.2	308.2
3	140.6	175.3	328.8	223.3	140.6	132.2	0.7	115.1	297.9	295.1
4	136.5	174.5	314.0	209.7	136.4	129.3	1.1	117.2	283.9	282.3
5	133.0	174.4	302.3	200.7	132.9	128.0	2.3	118.4	273.8	272.9
6	131.1	175.5	294.3	195.9	131.1	129.8	1.1	117.8	264.6	264.4
7	132.4	179.0	283.4	186.8	132.4	131.4	2.8	121.6	253.4	254.3
8	141.5	194.0	264.3	166.8	141.5	137.7	2.8	136.6	226.0	230.7
9	143.8	204.9	250.8	155.9	143.7	139.7	6.0	149.9	211.6	219.0
10	130.7	219.8	223.8	149.9	129.9	144.1	14.1	166.0	196.3	207.3
11	111.2	222.0	218.4	161.9	111.2	156.0	0.3	158.1	188.2	201.5

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.385	0.465	0.963	0.651	0.384	0.355	0.964	1.271
2	0.395	0.471	0.951	0.632	0.394	0.357	0.944	1.245
3	0.397	0.474	0.928	0.604	0.397	0.358	0.940	1.243
4	0.385	0.473	0.887	0.569	0.385	0.351	0.948	1.225
5	0.375	0.474	0.853	0.545	0.375	0.348	0.963	1.198
6	0.370	0.476	0.830	0.532	0.370	0.353	0.991	1.182
7	0.374	0.488	0.799	0.509	0.374	0.358	0.993	1.135
8	0.402	0.532	0.750	0.458	0.402	0.378	0.974	1.031
9	0.409	0.564	0.713	0.429	0.408	0.384	0.972	0.956
10	0.370	0.606	0.633	0.414	0.367	0.398	1.109	0.873
11	0.313	0.613	0.615	0.447	0.313	0.430	1.403	0.965

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	4.6	2.1	2.6	0.412	0.821	0.125	0.122	0.026	0.025
2	10.00	4.5	2.0	2.1	0.426	0.821	0.129	0.127	0.027	0.026
3	20.00	5.3	2.6	2.4	0.444	0.819	0.135	0.134	0.028	0.028
4	30.00	6.6	3.5	3.2	0.457	0.853	0.116	0.115	0.024	0.024
5	36.00	7.3	3.9	3.6	0.462	0.878	0.099	0.099	0.021	0.021
6	42.00	8.0	4.3	3.9	0.461	0.911	0.075	0.075	0.016	0.016
7	50.00	8.0	3.8	4.2	0.469	0.923	0.067	0.067	0.014	0.014
8	70.00	6.3	1.1	4.4	0.509	0.877	0.122	0.122	0.027	0.027
9	80.00	4.3	-1.1	4.1	0.529	0.867	0.145	0.145	0.033	0.033
10	90.00	3.0	-2.3	4.3	0.498	0.900	0.134	0.134	0.031	0.031
11	95.00	6.6	1.6	10.4	0.431	0.940	0.086	0.086	0.019	0.019

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR SECOND-STAGE ROTOR

(g) 80 Percent of design speed; reading 87

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	23.533	23.188	1.3	37.9	66.1	57.3	324.5	1.097	13.52	1.309
2	23.002	22.708	1.4	38.1	64.8	55.9	322.8	1.098	13.58	1.311
3	21.951	21.742	-1.3	36.5	63.8	53.6	319.5	1.098	13.61	1.318
4	20.899	20.780	-1.5	36.5	62.8	51.6	318.9	1.095	13.56	1.320
5	20.272	20.206	-0.1	37.7	62.0	49.8	319.5	1.092	13.53	1.323
6	19.647	19.637	0.3	38.3	61.4	47.9	319.9	1.091	13.47	1.329
7	18.814	18.887	1.0	39.2	60.3	44.8	320.1	1.090	13.49	1.332
8	16.721	17.071	-0.3	41.3	56.3	34.7	317.9	1.094	13.69	1.327
9	15.651	16.198	0.8	44.0	53.5	26.9	318.1	1.096	13.83	1.324
10	14.536	15.352	4.4	46.1	52.8	17.2	319.6	1.097	13.77	1.343
11	13.952	14.938	-0.4	43.6	58.3	16.4	320.0	1.097	13.38	1.370

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	140.0	170.5	345.5	249.2	140.0	134.6	3.2	104.7	319.0	314.3
2	145.0	172.9	340.7	242.7	145.0	136.0	3.4	106.7	311.7	307.7
3	148.3	174.9	335.5	237.0	148.3	140.6	-3.2	104.1	297.8	294.9
4	147.4	175.1	322.9	226.7	147.4	140.8	-3.9	104.0	283.3	281.7
5	145.9	176.7	310.9	216.7	145.9	139.9	-0.2	107.9	274.4	273.5
6	144.1	178.4	301.3	208.7	144.1	140.0	0.8	110.6	265.5	265.4
7	144.4	182.8	291.1	199.6	144.4	141.6	2.5	115.6	255.3	256.3
8	151.2	195.5	272.4	178.6	151.1	146.9	-0.8	128.9	225.8	230.6
9	154.4	206.0	259.6	166.3	154.4	148.2	2.3	143.1	211.0	218.3
10	141.2	221.6	232.8	160.8	140.8	153.6	10.9	159.8	196.4	207.4
11	116.6	223.1	222.0	168.3	116.6	161.5	-0.7	153.9	188.1	201.4

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT		
1	0.394	0.460	0.972	0.673	0.394	0.365	0.961	1.270
2	0.409	0.468	0.962	0.657	0.409	0.368	0.938	1.235
3	0.421	0.476	0.953	0.645	0.421	0.383	0.948	1.245
4	0.419	0.478	0.918	0.619	0.419	0.385	0.956	1.222
5	0.414	0.483	0.883	0.592	0.414	0.382	0.959	1.180
6	0.409	0.488	0.854	0.571	0.408	0.383	0.972	1.154
7	0.409	0.501	0.825	0.546	0.409	0.388	0.981	1.118
8	0.431	0.538	0.776	0.492	0.431	0.404	0.972	1.030
9	0.440	0.568	0.740	0.458	0.440	0.409	0.960	0.952
10	0.400	0.612	0.660	0.444	0.399	0.424	1.091	0.870
11	0.329	0.616	0.626	0.465	0.329	0.446	1.385	0.959

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	4.2	1.7	3.0	0.389	0.821	0.119	0.115	0.024	0.023
2	10.00	3.8	1.3	2.4	0.399	0.824	0.119	0.117	0.025	0.024
3	20.00	4.4	1.7	2.3	0.406	0.836	0.113	0.111	0.024	0.023
4	30.00	5.2	2.1	2.9	0.411	0.872	0.091	0.090	0.019	0.019
5	36.00	5.4	2.0	3.0	0.417	0.905	0.070	0.069	0.015	0.015
6	42.00	5.9	2.2	3.3	0.423	0.934	0.050	0.050	0.011	0.011
7	50.00	6.1	2.0	3.7	0.433	0.949	0.041	0.041	0.009	0.009
8	70.00	5.0	-0.2	4.7	0.476	0.898	0.093	0.093	0.021	0.021
9	80.00	2.8	-2.6	4.8	0.501	0.865	0.137	0.137	0.031	0.031
10	90.00	1.3	-4.0	5.5	0.468	0.910	0.111	0.111	0.025	0.025
11	95.00	5.5	0.5	11.2	0.408	0.969	0.042	0.042	0.009	0.009

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR SECOND-STAGE ROTOR

(h) 80 Percent of design speed; reading 98

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	23.533	23.188	0.1	29.8	65.4	58.7	319.1	1.078	12.95	1.237
2	23.002	22.708	-0.4	28.8	63.6	56.6	317.3	1.079	13.11	1.244
3	21.951	21.742	-2.6	25.7	61.6	54.3	315.1	1.077	13.23	1.247
4	20.899	20.780	-2.6	25.9	60.0	52.4	315.1	1.074	13.26	1.247
5	20.272	20.206	-1.3	27.4	59.0	50.6	315.6	1.073	13.23	1.254
6	19.647	19.637	-0.5	28.6	58.2	48.5	316.3	1.073	13.20	1.263
7	18.814	18.887	-0.4	29.8	56.8	45.4	316.7	1.075	13.22	1.270
8	16.721	17.071	-0.9	31.9	52.8	34.2	316.2	1.082	13.60	1.277
9	15.651	16.198	-0.6	34.1	50.2	26.5	317.0	1.088	13.76	1.304
10	14.536	15.352	1.5	37.0	48.8	17.2	319.4	1.092	13.89	1.310
11	13.952	14.938	-1.3	36.0	53.2	15.4	319.8	1.094	13.43	1.349

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	144.9	162.0	347.9	270.8	144.9	140.6	0.3	80.4	316.6	311.9
2	154.9	169.5	348.1	269.6	154.9	148.6	-1.2	81.6	310.6	306.6
3	164.4	173.4	345.0	268.2	164.2	156.3	-7.5	75.2	295.9	293.1
4	166.6	174.2	333.2	256.8	166.5	156.7	-7.5	76.1	281.1	279.5
5	166.1	176.4	322.4	246.7	166.1	156.6	-3.9	81.1	272.5	271.6
6	165.3	179.8	313.4	238.4	165.3	157.9	-1.5	86.0	264.7	264.6
7	166.4	184.9	304.2	228.2	166.4	160.4	-1.2	92.0	253.4	254.4
8	173.3	208.3	286.4	213.9	173.3	176.9	-2.7	109.9	225.4	230.1
9	178.6	225.7	278.9	209.0	178.6	187.0	-2.0	126.5	212.3	219.7
10	168.2	244.3	255.3	204.3	168.2	195.2	4.3	146.9	196.4	207.4
11	143.9	249.6	240.0	209.6	143.9	202.1	-3.3	146.6	188.8	202.1

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT		
1	0.411	0.444	0.988	0.743	0.411	0.385	0.970	1.265
2	0.442	0.467	0.994	0.743	0.442	0.409	0.959	1.230
3	0.472	0.480	0.991	0.743	0.472	0.433	0.952	1.212
4	0.479	0.483	0.958	0.712	0.478	0.435	0.941	1.175
5	0.477	0.469	0.926	0.685	0.477	0.435	0.943	1.134
6	0.474	0.499	0.899	0.662	0.474	0.438	0.955	1.105
7	0.477	0.513	0.872	0.633	0.477	0.445	0.964	1.070
8	0.498	0.581	0.823	0.596	0.498	0.493	1.021	0.982
9	0.513	0.630	0.802	0.583	0.513	0.522	1.047	0.925
10	0.480	0.682	0.729	0.571	0.480	0.545	1.160	0.847
11	0.408	0.698	0.681	0.586	0.408	0.565	1.404	0.922

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	3.5	1.0	4.4	0.308	0.802	0.105	0.100	0.021	0.020
2	10.00	2.5	0.0	3.0	0.313	0.812	0.101	0.098	0.021	0.020
3	20.00	2.1	-0.5	3.0	0.307	0.850	0.078	0.076	0.016	0.016
4	30.00	2.4	-0.7	3.7	0.314	0.881	0.063	0.063	0.013	0.013
5	36.00	2.4	-1.0	3.8	0.321	0.915	0.047	0.047	0.010	0.010
6	42.00	2.6	-1.1	4.0	0.328	0.948	0.030	0.030	0.006	0.006
7	50.00	2.7	-1.5	4.2	0.344	0.948	0.033	0.033	0.007	0.007
8	70.00	1.5	-3.7	4.2	0.362	0.888	0.082	0.082	0.019	0.019
9	80.00	-0.5	-5.9	4.4	0.371	0.894	0.087	0.087	0.020	0.020
10	90.00	-2.8	-8.0	5.5	0.338	0.870	0.130	0.130	0.030	0.030
11	95.00	0.3	-4.6	10.2	0.276	0.952	0.056	0.056	0.012	0.012

TABLE VIII. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE ROTOR

(i) 80 Percent of design speed; reading 109

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.533	23.188	-0.6	23.3	65.4	61.2	317.8	1.060	12.79	1.144
2	23.002	22.708	-0.8	22.3	63.2	57.7	316.3	1.064	12.99	1.164
3	21.951	21.742	-2.8	19.5	61.0	54.5	314.4	1.063	13.11	1.179
4	20.899	20.780	-2.5	19.6	59.4	52.3	314.4	1.061	13.16	1.189
5	20.272	20.206	-1.5	21.0	58.4	50.5	314.9	1.061	13.14	1.198
6	19.647	19.637	-1.0	22.3	57.7	48.7	315.8	1.062	13.09	1.206
7	18.814	18.887	-0.4	24.1	56.1	45.6	316.2	1.064	13.12	1.212
8	16.721	17.071	-0.8	27.3	51.5	34.3	316.0	1.074	13.60	1.223
9	15.651	16.198	-0.7	29.7	49.0	26.9	317.0	1.082	13.77	1.254
10	14.536	15.352	0.9	32.7	47.7	17.7	319.4	1.088	13.93	1.272
11	13.952	14.938	-1.2	31.8	51.6	15.1	319.9	1.091	13.46	1.326

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	146.1	151.6	351.6	289.4	146.1	139.3	-1.4	60.0	318.3	313.7
2	158.2	166.8	351.0	286.4	158.2	154.2	-2.3	63.4	311.0	307.1
3	169.0	177.3	348.1	287.9	168.7	167.2	-8.3	59.1	296.2	293.4
4	172.1	181.1	338.2	279.2	171.9	170.6	-7.6	60.9	283.6	282.0
5	171.7	183.6	327.6	269.4	171.7	171.4	-4.6	65.8	274.4	273.5
6	170.1	185.7	318.7	260.6	170.1	171.9	-3.1	70.4	266.4	266.3
7	171.7	190.4	308.0	248.5	171.7	173.8	-1.3	77.7	254.4	255.3
8	181.5	216.4	291.7	232.7	181.5	192.2	-2.6	99.4	225.7	230.4
9	187.1	235.0	284.9	228.9	187.1	204.2	-2.3	116.5	212.6	220.0
10	176.8	257.9	262.7	227.9	176.8	217.1	2.9	139.1	197.3	208.4
11	153.0	268.8	246.3	236.6	153.0	228.4	-3.2	141.7	189.9	203.3

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.416	0.419	1.001	0.800	0.416	0.385	0.953	1.283
2	0.453	0.463	1.005	0.801	0.453	0.428	0.975	1.224
3	0.486	0.496	1.002	0.805	0.486	0.467	0.991	1.201
4	0.496	0.507	0.974	0.782	0.495	0.478	0.992	1.173
5	0.494	0.514	0.943	0.754	0.494	0.480	0.999	1.133
6	0.489	0.520	0.916	0.729	0.489	0.481	1.010	1.111
7	0.493	0.532	0.885	0.695	0.493	0.486	1.013	1.061
8	0.523	0.607	0.841	0.653	0.523	0.539	1.059	0.958
9	0.539	0.660	0.821	0.643	0.539	0.573	1.091	0.899
10	0.506	0.725	0.752	0.641	0.506	0.611	1.228	0.837
11	0.435	0.758	0.700	0.667	0.435	0.644	1.493	0.909

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.5	1.0	7.0	0.242	0.650	0.142	0.136	0.026	0.025
2	10.00	2.2	-0.3	4.1	0.247	0.697	0.129	0.126	0.026	0.025
3	20.00	1.6	-1.1	3.1	0.241	0.768	0.099	0.096	0.020	0.020
4	30.00	1.8	-1.3	3.6	0.243	0.832	0.073	0.072	0.015	0.015
5	36.00	1.8	-1.6	3.7	0.248	0.869	0.059	0.059	0.012	0.012
6	42.00	2.2	-1.5	4.2	0.256	0.893	0.051	0.051	0.011	0.011
7	50.00	2.0	-2.2	4.5	0.272	0.888	0.059	0.059	0.013	0.013
8	70.00	0.2	-5.0	4.3	0.299	0.797	0.131	0.131	0.030	0.030
9	80.00	-1.8	-7.2	4.7	0.306	0.816	0.136	0.136	0.031	0.031
10	90.00	-3.8	-9.1	6.0	0.261	0.805	0.178	0.178	0.041	0.041
11	95.00	-1.2	-6.2	9.9	0.180	0.922	0.083	0.083	0.019	0.019

TABLE IX. - BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE STATOR

(a) 100 Percent of design speed; reading 16

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	23.109	23.129	43.6	0.6	43.6	0.6	401.2	1.000	24.08	0.976
2	22.647	22.685	43.2	2.6	43.2	2.6	398.2	1.000	24.13	0.977
3	21.727	21.801	41.4	2.3	41.4	2.3	392.6	1.000	24.15	0.976
4	20.823	20.922	41.3	1.8	41.3	1.8	388.8	1.000	24.02	0.983
5	20.287	20.401	41.4	0.9	41.4	0.9	387.3	1.000	23.98	0.983
6	19.756	19.883	40.5	-0.1	40.5	-0.1	385.9	1.000	23.86	0.985
7	19.060	19.205	40.0	-0.2	40.0	-0.2	384.2	1.000	23.85	0.996
8	17.369	17.567	41.6	-1.9	41.6	-1.9	380.0	1.000	24.06	0.981
9	16.548	16.787	44.6	0.4	44.6	0.4	380.7	1.000	23.92	0.981
10	15.740	16.040	47.9	1.8	47.9	1.8	382.4	1.000	23.79	0.951
11	15.339	15.682	47.0	0.7	47.0	0.7	383.4	1.000	23.44	0.943

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	229.0	171.2	229.0	171.2	165.8	171.2	158.0	1.9	0.	0.
2	231.1	172.9	231.1	172.9	168.6	172.7	158.0	7.9	0.	0.
3	232.7	173.2	232.7	173.2	174.5	173.0	154.0	7.1	0.	0.
4	234.7	172.9	234.7	172.9	176.4	172.9	154.9	5.6	0.	0.
5	236.1	171.8	236.1	171.8	177.2	171.8	156.0	2.7	0.	0.
6	236.1	170.4	236.1	170.4	179.4	170.4	153.4	-0.2	0.	0.
7	239.2	170.8	239.2	170.8	183.2	170.8	153.7	-0.6	0.	0.
8	248.0	176.1	248.0	176.1	185.6	176.0	164.6	-5.8	0.	0.
9	251.6	172.0	251.6	172.0	179.1	172.0	176.7	1.3	0.	0.
10	258.1	152.6	258.1	152.6	173.1	152.5	191.5	4.9	0.	0.
11	255.8	136.0	255.8	136.0	174.5	136.0	186.9	1.6	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT		
1	0.590	0.435	0.590	0.435	0.427	0.435	1.033	0.908
2	0.598	0.441	0.598	0.441	0.436	0.440	1.024	0.901
3	0.607	0.445	0.607	0.445	0.455	0.444	0.992	0.865
4	0.616	0.446	0.616	0.446	0.463	0.446	0.980	0.864
5	0.621	0.444	0.621	0.444	0.466	0.444	0.969	0.865
6	0.623	0.442	0.623	0.442	0.473	0.442	0.950	0.83[illegible]
7	0.633	0.444	0.633	0.444	0.485	0.444	0.932	0.827
8	0.662	0.460	0.662	0.460	0.495	0.460	0.949	0.858
9	0.672	0.449	0.672	0.449	0.478	0.449	0.960	0.913
10	0.689	0.396	0.689	0.396	0.462	0.395	0.881	0.978
11	0.681	0.351	0.681	0.351	0.465	0.351	0.779	0.925

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	7.7	2.0	14.8	0.518	0.	0.116	0.116	0.045	0.045
2	10.00	7.5	1.8	15.2	0.501	0.	0.107	0.107	0.041	0.041
3	20.00	6.0	0.4	12.9	0.488	0.	0.107	0.107	0.039	0.039
4	30.00	5.9	0.3	11.5	0.487	0.	0.076	0.076	0.027	0.027
5	36.00	5.8	0.2	10.4	0.495	0.	0.075	0.075	0.026	0.026
6	42.00	4.4	-1.1	9.3	0.495	0.	0.067	0.067	0.022	0.022
7	50.00	3.1	-2.4	9.1	0.493	0.	0.057	0.057	0.019	0.019
8	70.00	1.9	-3.4	7.8	0.492	0.	0.074	0.074	0.022	0.022
9	80.00	2.5	-2.7	11.0	0.511	0.	0.073	0.073	0.021	0.021
10	90.00	2.1	-3.0	14.8	0.601	0.	0.180	0.180	0.048	0.048
11	95.00	-1.1	-6.1	15.5	0.655	0.	0.212	0.212	0.055	0.055

TABLE IX. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE STATOR

(b) 100 Percent of design speed; reading 27

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	23.109	23.129	44.5	0.1	44.5	0.1	404.4	1.000	24.54	0.974
2	22.647	22.685	43.7	2.1	43.7	2.1	401.4	1.000	24.68	0.972
3	21.727	21.801	42.3	2.3	42.3	2.3	395.3	1.000	24.53	0.975
4	20.823	20.922	42.3	2.0	42.3	2.0	391.3	1.000	24.54	0.978
5	20.287	20.401	42.4	1.1	42.4	1.1	389.4	1.000	24.32	0.982
6	19.756	19.883	41.5	0.1	41.5	0.1	368.1	1.000	24.24	0.984
7	19.060	19.205	41.0	-0.0	41.0	-0.0	386.2	1.000	24.28	0.981
8	17.369	17.567	42.7	-1.6	42.7	-1.6	381.9	1.000	24.21	0.983
9	16.548	16.787	45.5	1.0	45.5	1.0	382.9	1.000	24.27	0.978
10	15.740	16.040	49.2	2.2	49.2	2.2	384.5	1.000	24.02	0.954
11	15.339	15.682	48.2	0.6	48.2	0.6	385.4	1.000	23.61	0.948

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	228.3	171.0	228.3	171.0	162.8	171.0	160.1	0.2	0.	0.
2	231.9	172.5	231.9	172.5	167.7	172.3	160.1	6.4	0.	0.
3	233.8	172.3	233.8	172.3	173.0	172.1	157.3	7.0	0.	0.
4	234.6	171.0	234.6	171.0	173.5	170.9	157.9	6.0	0.	0.
5	234.0	168.8	234.0	168.8	172.8	168.7	157.9	3.2	0.	0.
6	234.1	167.4	234.1	167.4	175.4	167.4	155.0	0.3	0.	0.
7	238.2	167.4	238.2	167.4	179.7	167.4	156.3	-0.1	0.	0.
8	248.2	170.7	248.2	170.7	182.5	170.6	168.2	-4.7	0.	0.
9	253.5	167.8	253.5	167.8	177.6	167.7	181.0	2.9	0.	0.
10	260.4	148.6	260.4	148.6	170.1	148.5	197.1	5.7	0.	0.
11	257.1	130.4	257.1	130.4	171.4	130.4	191.6	1.4	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT		
1	0.586	0.432	0.586	0.432	0.418	0.432	1.050	0.919
2	0.598	0.438	0.598	0.438	0.433	0.438	1.028	0.912
3	0.608	0.441	0.608	0.441	0.450	0.441	0.995	0.884
4	0.614	0.440	0.614	0.440	0.454	0.440	0.985	0.882
5	0.614	0.435	0.614	0.435	0.453	0.435	0.977	0.877
6	0.615	0.432	0.615	0.432	0.461	0.432	0.954	0.850
7	0.628	0.433	0.628	0.433	0.474	0.433	0.931	0.844
8	0.661	0.445	0.661	0.445	0.486	0.444	0.935	0.883
9	0.675	0.436	0.675	0.436	0.473	0.436	0.945	0.940
10	0.694	0.384	0.694	0.384	0.453	0.384	0.873	1.016
11	0.683	0.335	0.683	0.335	0.456	0.335	0.761	0.957

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	8.6	2.9	14.2	0.525	0.	0.124	0.124	0.049	0.049
2	10.00	8.1	2.3	14.7	0.510	0.	0.131	0.131	0.050	0.050
3	20.00	6.9	1.2	12.9	0.499	0.	0.114	0.114	0.042	0.042
4	30.00	7.0	1.3	11.7	0.499	0.	0.096	0.096	0.034	0.034
5	36.00	6.8	1.2	10.5	0.506	0.	0.081	0.081	0.028	0.028
6	42.00	5.4	-0.2	9.4	0.506	0.	0.073	0.073	0.024	0.024
7	50.00	4.1	-1.4	9.2	0.509	0.	0.080	0.080	0.026	0.026
8	70.00	3.0	-2.3	8.1	0.517	0.	0.066	0.066	0.019	0.019
9	80.00	3.5	-1.8	11.6	0.534	0.	0.085	0.085	0.024	0.024
10	90.00	3.5	-1.6	15.2	0.624	0.	0.166	0.166	0.044	0.044
11	95.00	0.1	-4.9	15.5	0.684	0.	0.193	0.193	0.050	0.050

TABLE IX. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE STATOR

(c) 100 Percent of design speed; reading 38

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.109	23.129	41.6	0.0	41.6	0.0	393.4	1.000	22.63	0.978
2	22.647	22.685	40.9	1.9	40.9	1.9	391.3	1.000	22.87	0.976
3	21.727	21.801	38.7	0.9	38.7	0.9	385.8	1.000	22.86	0.984
4	20.823	20.922	38.2	-0.0	38.2	-0.0	382.5	1.000	22.81	0.986
5	20.287	20.401	38.5	-0.8	38.5	-0.8	381.8	1.000	22.80	0.986
6	19.756	19.883	38.0	-1.4	38.0	-1.4	381.1	1.000	22.73	0.987
7	19.060	19.205	37.5	-1.2	37.5	-1.2	380.3	1.000	22.94	0.985
8	17.369	17.567	38.0	-1.9	38.0	-1.9	378.5	1.000	23.53	0.985
9	16.548	16.787	40.0	-1.6	40.0	-1.6	379.8	1.000	23.60	0.985
10	15.740	16.040	41.9	0.6	41.9	0.6	381.7	1.000	23.53	0.949
11	15.339	15.682	41.2	0.2	41.2	0.2	382.6	1.000	23.43	0.929

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	221.6	168.3	221.6	168.3	165.6	168.3	147.2	0.1	0.	0.
2	227.6	173.5	227.6	173.5	172.1	173.4	148.9	5.8	0.	0.
3	230.3	177.3	230.3	177.3	179.7	177.3	144.0	2.8	0.	0.
4	231.9	177.6	231.9	177.6	182.3	177.6	143.3	-0.1	0.	0.
5	233.8	177.2	233.8	177.2	182.9	177.2	145.6	-2.3	0.	0.
6	235.0	177.0	235.0	177.0	185.1	177.0	144.7	-4.3	0.	0.
7	241.7	180.8	241.7	180.8	191.7	180.8	147.1	-3.8	0.	0.
8	259.2	198.6	259.2	198.6	204.3	198.5	159.5	-6.4	0.	0.
9	265.7	200.2	265.7	200.2	203.6	200.1	170.7	-5.7	0.	0.
10	272.3	184.4	272.3	184.4	202.8	184.4	181.7	1.9	0.	0.
11	273.1	169.9	273.1	169.9	205.3	169.9	180.1	0.6	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.576	0.431	0.576	0.431	0.430	0.431	1.016	0.846
2	0.594	0.446	0.594	0.446	0.449	0.446	1.007	0.849
3	0.606	0.460	0.606	0.460	0.473	0.460	0.986	0.806
4	0.613	0.463	0.613	0.463	0.482	0.463	0.974	0.792
5	0.620	0.462	0.620	0.462	0.485	0.462	0.968	0.800
6	0.624	0.462	0.624	0.462	0.491	0.462	0.956	0.784
7	0.644	0.473	0.644	0.473	0.511	0.473	0.943	0.781
8	0.696	0.523	0.696	0.523	0.549	0.523	0.972	0.804
9	0.714	0.527	0.714	0.527	0.547	0.527	0.983	0.846
10	0.732	0.482	0.732	0.482	0.545	0.482	0.909	0.877
11	0.733	0.442	0.733	0.442	0.551	0.442	0.827	0.833

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	5.7	-0.0	14.2	0.500	0.	0.109	0.109	0.043	0.043
2	10.00	5.3	-0.5	14.5	0.479	0.	0.111	0.111	0.042	0.042
3	20.00	3.3	-2.4	11.4	0.455	0.	0.072	0.072	0.027	0.027
4	30.00	2.8	-2.8	9.7	0.452	0.	0.063	0.063	0.022	0.022
5	36.00	2.9	-2.7	8.7	0.459	0.	0.061	0.061	0.021	0.021
6	42.00	1.9	-3.6	7.9	0.458	0.	0.057	0.057	0.019	0.019
7	50.00	0.6	-4.9	8.1	0.453	0.	0.062	0.062	0.020	0.020
8	70.00	-1.7	-7.0	7.8	0.422	0.	0.054	0.054	0.016	0.016
9	80.00	-2.1	-7.3	9.0	0.432	0.	0.052	0.052	0.015	0.015
10	90.00	-3.9	-9.0	13.5	0.498	0.	0.169	0.169	0.045	0.045
11	95.00	-6.8	-11.8	15.1	0.548	0.	0.236	0.236	0.062	0.062

TABLE IX. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR SECOND-STAGE STATOR

(d) 100 Percent of design speed; reading 49

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	23.109	23.129	34.6	-2.6	34.6	-2.6	380.7	1.000	19.94	0.963
2	22.647	22.685	32.9	-0.7	32.9	-0.7	378.7	1.000	20.42	0.979
3	21.727	21.801	30.1	-1.2	30.1	-1.2	374.3	1.000	20.73	0.985
4	20.823	20.922	30.0	-1.5	30.0	-1.5	371.8	1.000	20.71	0.988
5	20.287	20.401	30.7	-1.4	30.7	-1.4	371.5	1.000	20.68	0.988
6	19.756	19.883	30.8	-1.9	30.8	-1.9	371.3	1.000	20.62	0.987
7	19.060	19.205	31.4	-2.6	31.4	-2.6	371.3	1.000	20.62	0.987
8	17.369	17.567	33.4	-3.2	33.4	-3.2	373.1	1.000	21.43	0.985
9	16.548	16.787	35.1	-1.7	35.1	-1.7	376.3	1.000	22.24	0.984
10	15.740	16.040	37.4	0.4	37.4	0.4	380.5	1.000	22.78	0.951
11	15.339	15.682	37.0	0.2	37.0	0.2	381.3	1.000	22.73	0.911

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	208.4	171.5	208.4	171.5	171.6	171.3	118.3	-7.9	0.	0.
2	220.6	182.5	220.6	182.5	185.3	182.5	119.7	-2.2	0.	0.
3	229.7	193.3	229.7	193.3	198.7	193.3	115.3	-4.0	0.	0.
4	231.3	195.3	231.3	195.3	200.3	195.3	115.7	-5.1	0.	0.
5	232.1	194.6	232.1	194.6	199.5	194.6	118.6	-4.9	0.	0.
6	232.1	193.6	232.1	193.6	199.4	193.5	118.7	-6.5	0.	0.
7	234.8	194.5	234.8	194.5	200.4	194.3	122.3	-9.0	0.	0.
8	258.6	219.6	258.6	219.6	215.8	219.3	142.5	-12.1	0.	0.
9	276.5	239.1	276.5	239.1	226.3	239.0	158.9	-7.1	0.	0.
10	292.1	238.4	292.1	238.4	232.0	238.4	177.4	1.5	0.	0.
11	293.0	219.0	293.0	219.0	233.9	219.0	176.4	0.7	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT		
1	0.549	0.447	0.549	0.447	0.452	0.447	0.998	0.669
2	0.585	0.479	0.585	0.479	0.491	0.479	0.985	0.659
3	0.614	0.512	0.614	0.512	0.532	0.511	0.973	0.614
4	0.621	0.519	0.621	0.519	0.538	0.519	0.975	0.621
5	0.624	0.517	0.624	0.517	0.536	0.517	0.975	0.624
6	0.624	0.514	0.624	0.514	0.536	0.514	0.970	0.624
7	0.632	0.517	0.632	0.517	0.539	0.517	0.970	0.632
8	0.700	0.587	0.700	0.587	0.584	0.586	1.016	0.700
9	0.750	0.640	0.750	0.640	0.614	0.639	1.056	0.750
10	0.793	0.634	0.793	0.634	0.630	0.634	1.027	0.795
11	0.794	0.578	0.794	0.578	0.634	0.578	0.937	0.794

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	-1.3	-7.0	11.6	0.414	0.	0.093	0.093	0.036	0.036
2	10.00	-2.7	-8.5	11.9	0.384	0.	0.102	0.102	0.039	0.039
3	20.00	-5.3	-11.0	9.3	0.349	0.	0.068	0.068	0.025	0.025
4	30.00	-5.3	-11.0	8.2	0.339	0.	0.052	0.052	0.018	0.018
5	36.00	-4.9	-10.4	8.0	0.344	0.	0.053	0.053	0.018	0.018
6	42.00	-5.3	-10.9	7.4	0.346	0.	0.056	0.056	0.019	0.019
7	50.00	-5.5	-11.0	6.6	0.351	0.	0.053	0.053	0.017	0.017
8	70.00	-6.2	-11.5	6.5	0.326	0.	0.055	0.055	0.016	0.016
9	80.00	-7.0	-12.2	8.9	0.303	0.	0.051	0.051	0.014	0.014
10	90.00	-8.3	-13.4	13.3	0.344	0.	0.144	0.144	0.039	0.039
11	95.00	-11.1	-16.1	15.0	0.407	0.	0.262	0.262	0.069	0.069

TABLE IX. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE STATOR

(e) 80 Percent of design speed; reading 65

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.109	23.129	34.3	-2.1	34.3	-2.1	349.9	1.000	16.87	0.989
2	22.647	22.685	33.3	-0.5	33.3	-0.5	348.7	1.000	17.11	0.993
3	21.727	21.801	30.1	-1.7	30.1	-1.7	345.3	1.000	17.26	0.992
4	20.823	20.922	29.3	-2.6	29.3	-2.6	343.6	1.000	17.31	0.993
5	20.287	20.401	30.4	-2.5	30.4	-2.5	343.7	1.000	17.35	0.993
6	19.756	19.883	31.2	-2.3	31.2	-2.3	344.1	1.000	17.39	0.992
7	19.060	19.205	32.2	-2.4	32.2	-2.4	344.7	1.000	17.50	0.990
8	17.369	17.567	34.2	-3.4	34.2	-3.4	345.6	1.000	17.90	0.990
9	16.548	16.787	36.6	-1.8	36.6	-1.8	347.6	1.000	18.30	0.985
10	15.740	16.040	39.4	0.7	39.4	0.7	350.0	1.000	18.38	0.963
11	15.339	15.682	38.2	0.4	38.2	0.4	350.6	1.000	18.34	0.940

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	166.0	136.2	166.0	136.2	137.1	136.1	93.5	-4.9	0.	0.
2	174.8	148.1	174.8	148.1	146.0	148.1	96.0	-1.3	0.	0.
3	181.2	155.5	181.2	155.5	156.6	155.4	91.0	-4.6	0.	0.
4	183.9	157.4	183.9	157.4	160.5	157.2	89.9	-7.2	0.	0.
5	186.5	159.3	186.5	159.3	160.9	159.1	94.2	-6.9	0.	0.
6	189.1	160.8	189.1	160.8	161.7	160.7	98.1	-6.4	0.	0.
7	194.0	163.6	194.0	163.6	164.0	163.5	103.5	-6.9	0.	0.
8	213.7	182.4	213.7	182.4	176.6	182.1	120.2	-10.7	0.	0.
9	225.4	192.1	225.4	192.1	180.9	192.0	134.6	-5.9	0.	0.
10	235.6	166.7	235.6	186.7	182.1	186.7	149.5	2.3	0.	0.
11	236.5	174.1	236.5	174.1	185.9	174.1	146.1	1.1	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.452	0.368	0.452	0.368	0.373	0.368	0.993	0.546
2	0.478	0.402	0.478	0.402	0.399	0.402	1.014	0.549
3	0.498	0.425	0.498	0.425	0.431	0.425	0.992	0.498
4	0.508	0.431	0.508	0.431	0.443	0.431	0.980	0.508
5	0.515	0.437	0.515	0.437	0.444	0.436	0.989	0.515
6	0.522	0.441	0.522	0.441	0.447	0.440	0.994	0.522
7	0.536	0.449	0.536	0.449	0.453	0.448	0.997	0.536
8	0.593	0.502	0.593	0.502	0.490	0.501	1.031	0.593
9	0.627	0.528	0.627	0.528	0.503	0.528	1.062	0.627
10	0.655	0.511	0.655	0.511	0.506	0.511	1.025	0.713
11	0.657	0.474	0.657	0.474	0.516	0.474	0.937	0.657

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-1.5	-7.3	12.2	0.411	0.	0.083	0.083	0.032	0.032
2	10.00	-2.2	-7.9	12.2	0.366	0.	0.045	0.045	0.017	0.017
3	20.00	-5.2	-10.9	8.9	0.335	0.	0.054	0.054	0.020	0.020
4	30.00	-6.0	-11.6	7.1	0.330	0.	0.045	0.045	0.016	0.016
5	36.00	-5.2	-10.8	7.0	0.332	0.	0.042	0.042	0.014	0.014
6	42.00	-4.8	-10.3	7.1	0.334	0.	0.047	0.047	0.016	0.016
7	50.00	-4.6	-10.1	6.9	0.340	0.	0.059	0.059	0.019	0.019
8	70.00	-5.3	-10.7	6.4	0.326	0.	0.046	0.046	0.013	0.013
9	80.00	-5.4	-10.6	8.9	0.322	0.	0.063	0.063	0.018	0.018
10	90.00	-6.3	-11.4	13.7	0.373	0.	0.147	0.147	0.039	0.039
11	95.00	-9.8	-14.8	15.3	0.422	0.	0.238	0.238	0.062	0.062

TABLE IX. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR SECOND-STAGE STATOR

(f) 80 Percent of design speed; reading 76

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	23.109	23.129	39.5	-0.1	39.5	-0.1	359.3	1.000	18.16	0.980
2	22.647	22.685	39.6	1.6	39.6	1.6	358.4	1.000	18.25	0.983
3	21.727	21.801	39.4	0.9	39.4	0.9	355.4	1.000	18.22	0.987
4	20.823	20.922	40.1	0.0	40.1	0.0	353.7	1.000	18.16	0.989
5	20.287	20.401	40.6	-0.2	40.6	-0.2	352.7	1.000	18.07	0.989
6	19.756	19.883	39.9	-0.6	39.9	-0.6	352.3	1.000	18.08	0.989
7	19.060	19.205	40.3	-1.2	40.3	-1.2	351.6	1.000	18.10	0.990
8	17.369	17.567	42.4	-2.4	42.4	-2.4	349.4	1.000	18.17	0.994
9	16.548	16.787	44.9	-0.2	44.9	-0.2	349.9	1.000	18.42	0.988
10	15.740	16.040	47.7	0.8	47.7	0.8	351.2	1.000	18.41	0.964
11	15.339	15.682	44.8	-0.6	44.8	-0.6	351.7	1.000	18.29	0.953

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	176.2	133.1	176.2	133.1	135.9	133.1	112.1	-0.3	0.	0.
2	179.7	138.2	179.7	138.2	138.4	138.2	114.6	3.8	0.	0.
3	181.7	141.3	181.7	141.3	140.5	141.3	115.2	2.3	0.	0.
4	181.5	138.9	181.5	138.9	138.7	138.9	116.9	0.0	0.	0.
5	181.4	136.5	181.4	136.5	137.8	136.5	117.9	-0.6	0.	0.
6	182.6	136.3	182.6	136.3	140.1	136.3	117.1	-1.5	0.	0.
7	186.1	138.0	186.1	138.0	141.9	138.0	120.5	-2.8	0.	0.
8	199.0	150.0	199.0	150.0	146.9	149.9	134.2	-6.3	0.	0.
9	207.8	153.5	207.8	153.5	147.1	153.5	146.7	-0.4	0.	0.
10	218.8	141.9	218.8	141.9	147.2	141.9	161.9	2.0	0.	0.
11	218.5	129.7	218.5	129.7	155.1	129.7	153.9	-1.4	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT		
1	0.474	0.355	0.474	0.355	0.366	0.355	0.980	0.664
2	0.485	0.369	0.485	0.369	0.373	0.369	0.999	0.673
3	0.492	0.379	0.492	0.379	0.381	0.379	1.006	0.667
4	0.493	0.374	0.493	0.374	0.377	0.374	1.001	0.672
5	0.494	0.368	0.494	0.368	0.375	0.368	0.990	0.675
6	0.497	0.367	0.497	0.367	0.382	0.367	0.973	0.661
7	0.508	0.372	0.508	0.372	0.387	0.372	0.973	0.671
8	0.547	0.407	0.547	0.407	0.404	0.407	1.021	0.727
9	0.572	0.417	0.572	0.417	0.405	0.417	1.044	0.785
10	0.604	0.384	0.604	0.384	0.406	0.383	0.964	0.855
11	0.602	0.349	0.602	0.349	0.427	0.349	0.836	0.772

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS			.	TOT	PROF	TOT	PROF
1	5.00	3.7	-2.1	14.1	0.493	0.	0.138	0.138	0.054	0.054
2	10.00	4.1	-1.7	14.2	0.467	0.	0.114	0.114	0.044	0.044
3	20.00	4.0	-1.6	11.5	0.451	0.	0.082	0.082	0.030	0.030
4	30.00	4.8	-0.8	9.7	0.461	0.	0.074	0.074	0.026	0.026
5	36.00	5.0	-0.6	9.3	0.471	0.	0.072	0.072	0.025	0.025
6	42.00	3.9	-1.7	8.8	0.470	0.	0.074	0.074	0.025	0.025
7	50.00	3.5	-2.0	8.2	0.471	0.	0.063	0.063	0.020	0.020
8	70.00	2.8	-2.5	7.3	0.453	0.	0.035	0.035	0.010	0.010
9	80.00	2.9	-2.3	10.5	0.459	0.	0.062	0.062	0.018	0.018
10	90.00	2.1	-3.1	13.8	0.545	0.	0.164	0.164	0.044	0.044
11	95.00	-3.2	-8.2	14.3	0.590	0.	0.215	0.215	0.056	0.056

TABLE IX. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE STATOR

(g) 80 Percent of design speed; reading 87

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.109	23.129	37.2	-1.3	37.2	-1.3	356.1	1.000	17.69	0.986
2	22.647	22.685	37.0	0.6	37.0	0.6	354.3	1.000	17.81	0.988
3	21.727	21.801	34.9	-0.5	34.9	-0.5	350.9	1.000	17.94	0.988
4	20.823	20.922	34.4	-1.7	34.4	-1.7	349.1	1.000	17.89	0.992
5	20.287	20.401	35.5	-1.8	35.5	-1.8	348.9	1.000	17.90	0.992
6	19.756	19.883	36.0	-1.5	36.0	-1.5	348.9	1.000	17.91	0.990
7	19.060	19.205	36.8	-1.1	36.8	-1.1	348.8	1.000	17.97	0.989
8	17.369	17.567	38.9	-2.6	38.9	-2.6	347.7	1.000	18.17	0.990
9	16.548	16.787	41.9	-1.3	41.9	-1.3	348.8	1.000	18.31	0.991
10	15.740	16.040	44.8	0.5	44.8	0.5	350.5	1.000	18.50	0.962
11	15.339	15.682	43.0	-0.5	43.0	-0.5	351.0	1.000	18.33	0.949

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	173.7	136.4	173.7	136.4	138.4	136.3	105.0	-3.1	0.	0.
2	178.0	141.9	178.0	141.9	142.2	141.9	107.0	1.6	0.	0.
3	182.3	147.0	182.3	147.0	149.6	147.0	104.2	-1.2	0.	0.
4	183.7	148.3	183.7	148.3	151.5	148.2	103.8	-4.4	0.	0.
5	185.3	148.3	185.3	148.3	150.9	148.2	107.5	-4.6	0.	0.
6	187.1	148.1	187.1	148.1	151.4	148.1	109.9	-3.9	0.	0.
7	191.3	149.7	191.3	149.7	153.2	149.7	114.6	-3.0	0.	0.
8	201.8	162.6	201.8	162.6	157.0	162.5	126.7	-7.3	0.	0.
9	209.8	168.0	209.8	168.0	156.3	168.0	140.0	-3.7	0.	0.
10	221.3	159.3	221.3	159.3	157.1	159.3	155.8	1.4	0.	0.
11	219.7	145.5	219.7	145.5	160.6	145.5	149.9	-1.3	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.469	0.365	0.469	0.365	0.374	0.365	0.985	0.619
2	0.483	0.382	0.483	0.382	0.386	0.381	0.998	0.625
3	0.497	0.398	0.497	0.398	0.408	0.398	0.982	0.590
4	0.503	0.402	0.503	0.402	0.415	0.402	0.978	0.575
5	0.508	0.403	0.508	0.403	0.413	0.402	0.982	0.596
6	0.513	0.402	0.513	0.402	0.415	0.402	0.978	0.604
7	0.525	0.407	0.525	0.407	0.420	0.406	0.977	0.623
8	0.556	0.444	0.556	0.444	0.433	0.443	1.035	0.666
9	0.579	0.458	0.579	0.458	0.431	0.458	1.075	0.731
10	0.611	0.433	0.611	0.433	0.434	0.433	1.014	0.802
11	0.606	0.393	0.606	0.393	0.443	0.393	0.906	0.736

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	1.4	-4.4	13.0	0.458	0.	0.102	0.102	0.040	0.040
2	10.00	1.4	-4.3	13.3	0.430	0.	0.083	0.083	0.032	0.032
3	20.00	-0.5	-6.1	10.1	0.406	0.	0.078	0.078	0.029	0.029
4	30.00	-0.9	-6.5	8.1	0.400	0.	0.051	0.051	0.018	0.018
5	36.00	-0.1	-5.7	7.8	0.407	0.	0.052	0.052	0.018	0.018
6	42.00	-0.0	-5.6	7.9	0.411	0.	0.064	0.064	0.021	0.021
7	50.00	-0.0	-5.5	8.2	0.415	0.	0.066	0.066	0.021	0.021
8	70.00	-0.7	-6.0	7.2	0.389	0.	0.053	0.053	0.016	0.016
9	80.00	-0.1	-5.4	9.4	0.391	0.	0.044	0.044	0.012	0.012
10	90.00	-0.9	-6.0	13.5	0.465	0.	0.169	0.169	0.045	0.045
11	95.00	-5.0	-10.0	14.4	0.516	0.	0.231	0.231	0.060	0.060

TABLE IX. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE STATOR

(h) 80 Percent of design speed; reading 98

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.109	23.129	29.2	-2.9	29.2	-2.9	344.0	1.000	16.02	0.986
2	22.647	22.685	27.7	-1.7	27.7	-1.7	342.5	1.000	16.31	0.989
3	21.727	21.801	24.3	-2.9	24.3	-2.9	339.3	1.000	16.50	0.987
4	20.823	20.922	24.2	-3.3	24.2	-3.3	338.4	1.000	16.54	0.990
5	20.287	20.401	25.4	-2.9	25.4	-2.9	338.6	1.000	16.58	0.991
6	19.756	19.883	26.5	-2.4	26.5	-2.4	339.3	1.000	16.68	0.989
7	19.060	19.205	27.6	-2.4	27.6	-2.4	340.3	1.000	16.79	0.990
8	17.369	17.567	29.5	-4.0	29.5	-4.0	342.0	1.000	17.37	0.987
9	16.548	16.787	31.9	-2.5	31.9	-2.5	344.9	1.000	17.93	0.979
10	15.740	16.040	35.5	0.5	35.5	0.5	348.9	1.000	18.19	0.961
11	15.339	15.682	35.4	0.2	35.4	0.2	349.8	1.000	18.11	0.929

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	165.6	145.9	165.6	145.9	144.6	145.7	80.7	-7.3	0.	0.
2	175.8	157.9	175.8	157.9	155.6	157.8	81.8	-4.8	0.	0.
3	183.1	166.0	183.1	166.0	166.9	165.8	75.2	-8.5	0.	0.
4	185.5	168.6	185.5	168.6	169.3	168.3	76.0	-9.6	0.	0.
5	188.0	171.1	188.0	171.1	169.8	170.9	80.7	-8.7	0.	0.
6	191.8	173.9	191.8	173.9	171.6	173.8	85.5	-7.4	0.	0.
7	196.9	178.7	196.9	178.7	174.5	178.5	91.2	-7.5	0.	0.
8	219.2	199.6	219.2	199.6	190.7	199.2	108.1	-13.8	0.	0.
9	234.4	214.3	234.4	214.3	199.0	214.1	123.8	-9.4	0.	0.
10	246.5	214.2	246.5	214.2	200.6	214.2	143.3	1.9	0.	0.
11	246.4	198.3	246.4	198.3	200.8	198.3	142.7	0.6	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.455	0.399	0.455	0.399	0.397	0.398	1.008	0.455
2	0.485	0.434	0.485	0.434	0.429	0.433	1.014	0.485
3	0.509	0.459	0.509	0.459	0.464	0.459	0.993	0.509
4	0.516	0.467	0.516	0.467	0.471	0.466	0.995	0.516
5	0.524	0.474	0.524	0.474	0.473	0.474	1.006	0.524
6	0.534	0.482	0.534	0.482	0.478	0.481	1.012	0.534
7	0.548	0.495	0.548	0.495	0.486	0.494	1.023	0.548
8	0.613	0.555	0.613	0.555	0.534	0.554	1.044	0.613
9	0.656	0.596	0.656	0.596	0.557	0.595	1.076	0.656
10	0.689	0.592	0.689	0.592	0.561	0.592	1.068	0.689
11	0.688	0.544	0.688	0.544	0.561	0.544	0.987	0.688

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-6.7	-12.4	11.4	0.327	0.	0.102	0.102	0.040	0.040
2	10.00	-7.8	-13.6	10.9	0.291	0.	0.071	0.071	0.027	0.027
3	20.00	-11.1	-16.8	7.7	0.261	0.	0.082	0.082	0.030	0.030
4	30.00	-11.1	-16.8	6.5	0.254	0.	0.060	0.060	0.021	0.021
5	36.00	-10.1	-15.7	6.6	0.2[illegible]	0.	0.054	0.054	0.019	0.019
6	42.00	-9.5	-15.1	7.0	0.255	0.	0.062	0.062	0.021	0.021
7	50.00	-9.2	-14.7	6.9	0.254	0.	0.055	0.055	0.018	0.018
8	70.00	-10.0	-15.4	5.8	0.253	0.	0.058	0.058	0.017	0.017
9	80.00	-10.1	-15.4	8.2	0.245	0.	0.083	0.083	0.023	0.023
10	90.00	-10.1	-15.2	13.5	0.283	0.	0.142	0.142	0.038	0.038
11	95.00	-12.6	-17.6	15.1	0.344	0.	0.261	0.261	0.068	0.068

TABLE IX. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES FOR

SECOND-STAGE STATOR

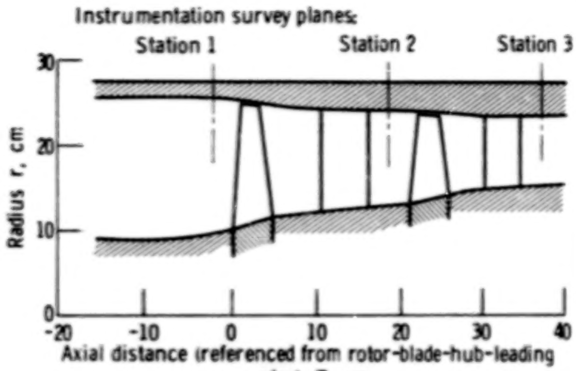
(i) 80 Percent of design speed; reading 109

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.109	23.129	22.8	-4.5	22.8	-4.5	337.0	1.000	14.64	0.966
2	22.647	22.685	21.5	-3.7	21.5	-3.7	336.4	1.000	15.11	0.967
3	21.727	21.801	18.3	-3.8	18.3	-3.8	334.2	1.000	15.47	0.981
4	20.823	20.922	18.2	-3.9	18.2	-3.9	333.6	1.000	15.65	0.975
5	20.287	20.401	19.3	-3.4	19.3	-3.4	334.1	1.000	15.74	0.976
6	19.756	19.883	20.4	-3.1	20.4	-3.1	335.2	1.000	15.79	0.980
7	19.060	19.205	22.1	-3.0	22.1	-3.0	336.4	1.000	15.90	0.981
8	17.369	17.567	25.1	-3.6	25.1	-3.6	339.4	1.000	16.64	0.982
9	16.548	16.787	27.5	-2.2	27.5	-2.2	342.9	1.000	17.26	0.977
10	15.740	16.040	31.2	1.4	31.2	1.4	347.6	1.000	17.71	0.955
11	15.339	15.682	31.3	1.0	31.3	1.0	349.0	1.000	17.85	0.910

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	155.4	151.8	155.4	151.8	143.3	151.4	60.2	-12.0	0.	0.
2	173.7	170.0	173.7	170.0	161.7	169.7	63.5	-11.0	0.	0.
3	188.6	182.5	188.6	182.5	179.1	182.1	59.1	-12.0	0.	0.
4	194.8	185.9	194.8	185.9	185.1	185.5	60.8	-12.5	0.	0.
5	198.0	189.5	198.0	189.5	186.9	189.1	65.5	-11.3	0.	0.
6	200.4	193.3	200.4	193.3	187.8	193.1	70.0	-10.3	0.	0.
7	205.1	198.9	205.1	198.9	190.1	198.7	77.0	-10.3	0.	0.
8	230.3	224.0	230.3	224.0	208.5	223.6	97.7	-14.0	0.	0.
9	246.6	242.6	246.6	242.6	218.7	242.4	114.0	-9.3	0.	0.
10	262.0	248.5	262.0	248.5	224.1	248.4	135.7	6.1	0.	0.
11	265.6	236.1	265.6	236.1	226.9	236.1	138.0	4.0	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.430	0.420	0.430	0.420	0.396	0.419	1.056	0.430
2	0.484	0.473	0.484	0.473	0.450	0.472	1.049	0.484
3	0.529	0.511	0.529	0.511	0.502	0.510	1.017	0.529
4	0.548	0.521	0.548	0.521	0.521	0.520	1.002	0.548
5	0.557	0.531	0.557	0.531	0.526	0.531	1.012	0.557
6	0.563	0.542	0.563	0.542	0.528	0.541	1.028	0.563
7	0.576	0.558	0.576	0.558	0.534	0.557	1.045	0.576
8	0.649	0.630	0.649	0.630	0.588	0.629	1.072	0.649
9	0.696	0.683	0.696	0.683	0.617	0.683	1.108	0.696
10	0.738	0.697	0.738	0.697	0.631	0.696	1.109	0.738
11	0.748	0.657	0.748	0.657	0.639	0.657	1.040	0.748

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-13.0	-18.8	9.7	0.204	0.	0.119	0.119	0.046	0.046
2	10.00	-14.1	-19.8	9.0	0.186	0.	0.085	0.085	0.032	0.032
3	20.00	-17.0	-22.7	6.8	0.171	0.	0.109	0.109	0.040	0.040
4	30.00	-17.1	-22.7	5.9	0.178	0.	0.135	0.135	0.047	0.047
5	36.00	-16.2	-21.8	6.1	0.176	0.	0.126	0.126	0.043	0.043
6	42.00	-15.6	-21.1	6.3	0.169	0.	0.105	0.105	0.035	0.035
7	50.00	-14.8	-20.2	6.4	0.167	0.	0.093	0.093	0.030	0.030
8	70.00	-14.5	-19.8	6.2	0.170	0.	0.075	0.075	0.022	0.022
9	80.00	-14.5	-19.7	8.5	0.156	0.	0.084	0.084	0.024	0.024
10	90.00	-14.5	-19.6	14.4	0.183	0.	0.148	0.148	0.040	0.040
11	95.00	-16.7	-21.7	15.9	0.241	0.	0.289	0.289	0.076	0.076



Flow path coordinates

Axial distance Z, cm	Radius, r, cm	
	Outer	Inner
-15.237	25.654	8.994
-10.160	25.654	8.903
-5.080	25.654	9.093
[a]-2.347	25.651	9.543
0	25.570	10.160
2.540	25.128	10.973
5.080	24.681	11.565
7.620	24.460	11.902
10.160	24.384	12.139
12.700		12.438
15.240		12.822
17.780		13.025
[a]18.659		13.038
20.320	24.328	13.152
22.860	23.993	13.627
25.400	23.655	14.371
27.940	23.622	14.699
30.033		14.849
34.610		15.237
[a]36.706		15.240
40.640		15.240

[a]Instrumentation survey plane

Figure 1. - Flow path for two-stage fan.

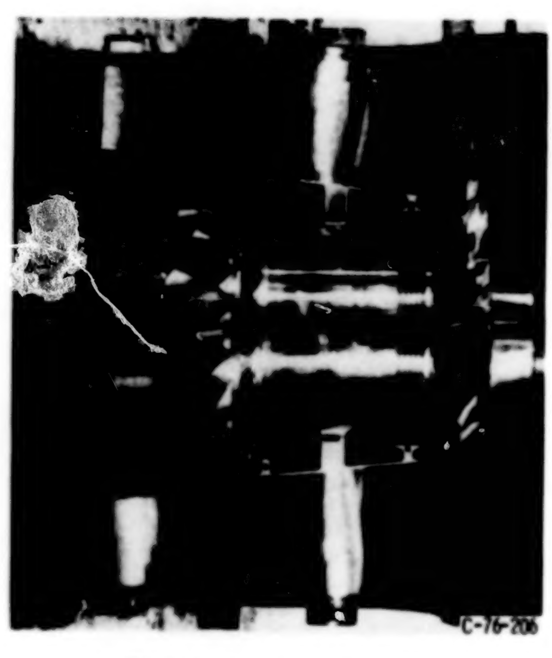
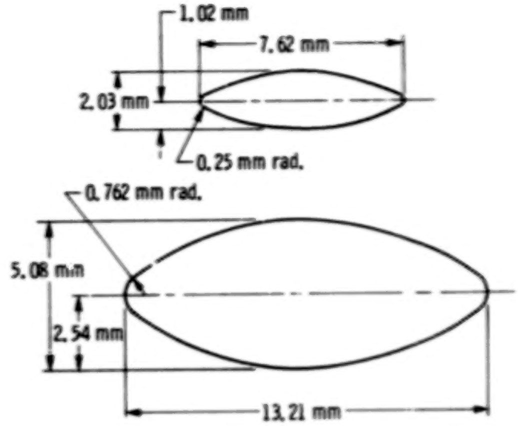


Figure 2. - Two-stage fan assembly.



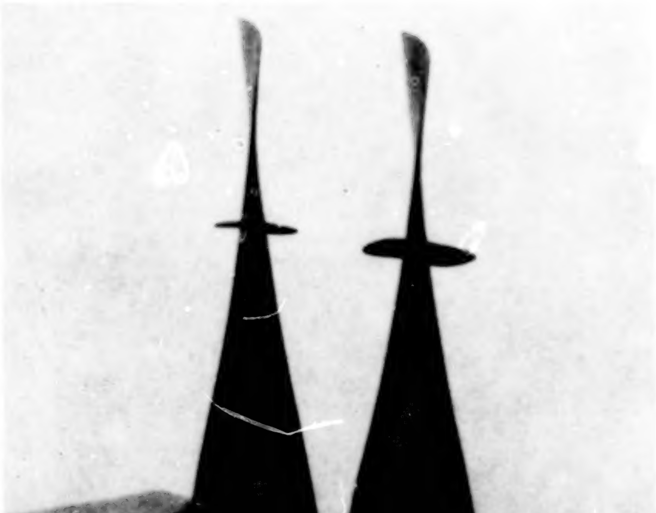


Figure 3. - Comparison of damper size.

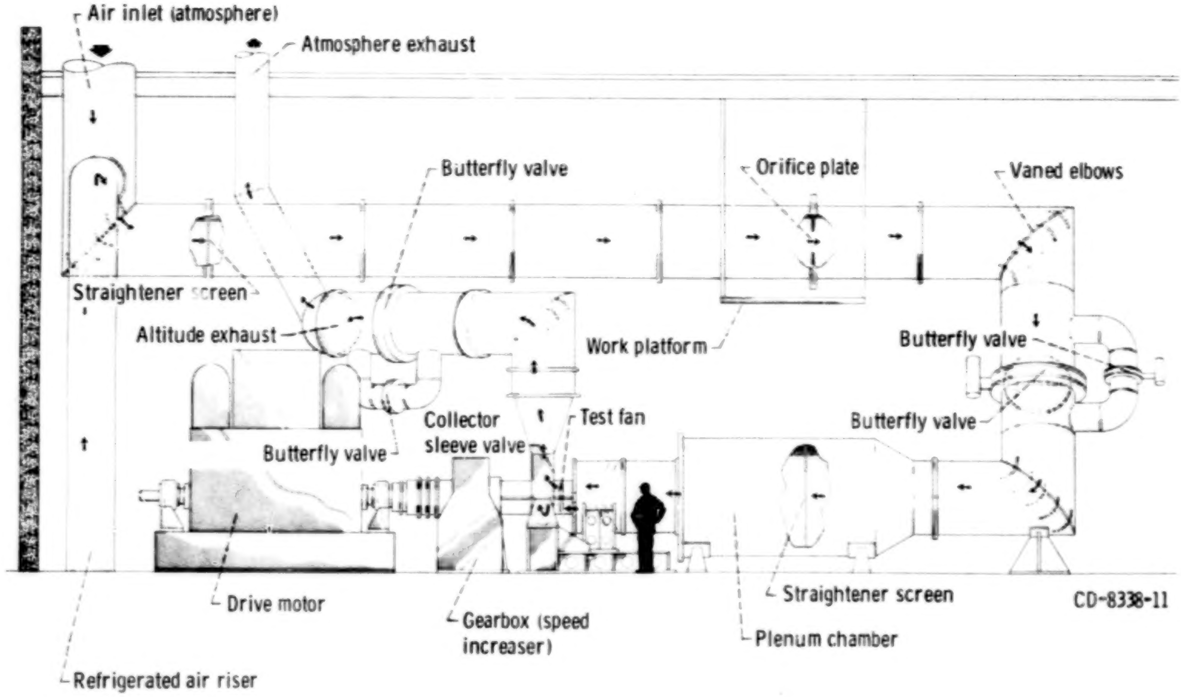


Figure 4. - Multistage compressor test facility.

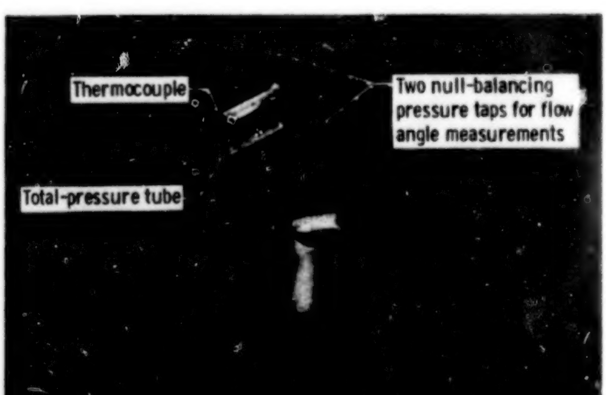


Figure 5. - Combination total-pressure, total-temperature, and flow-angle probe (double barrel).

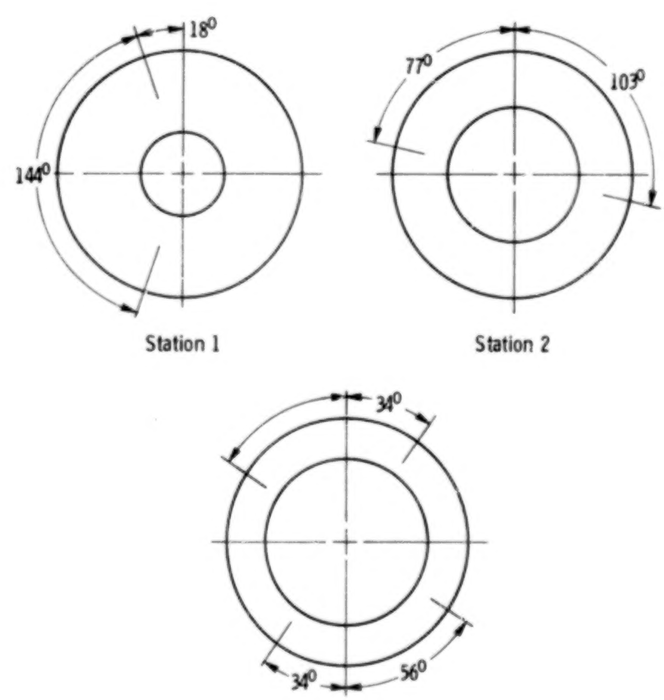
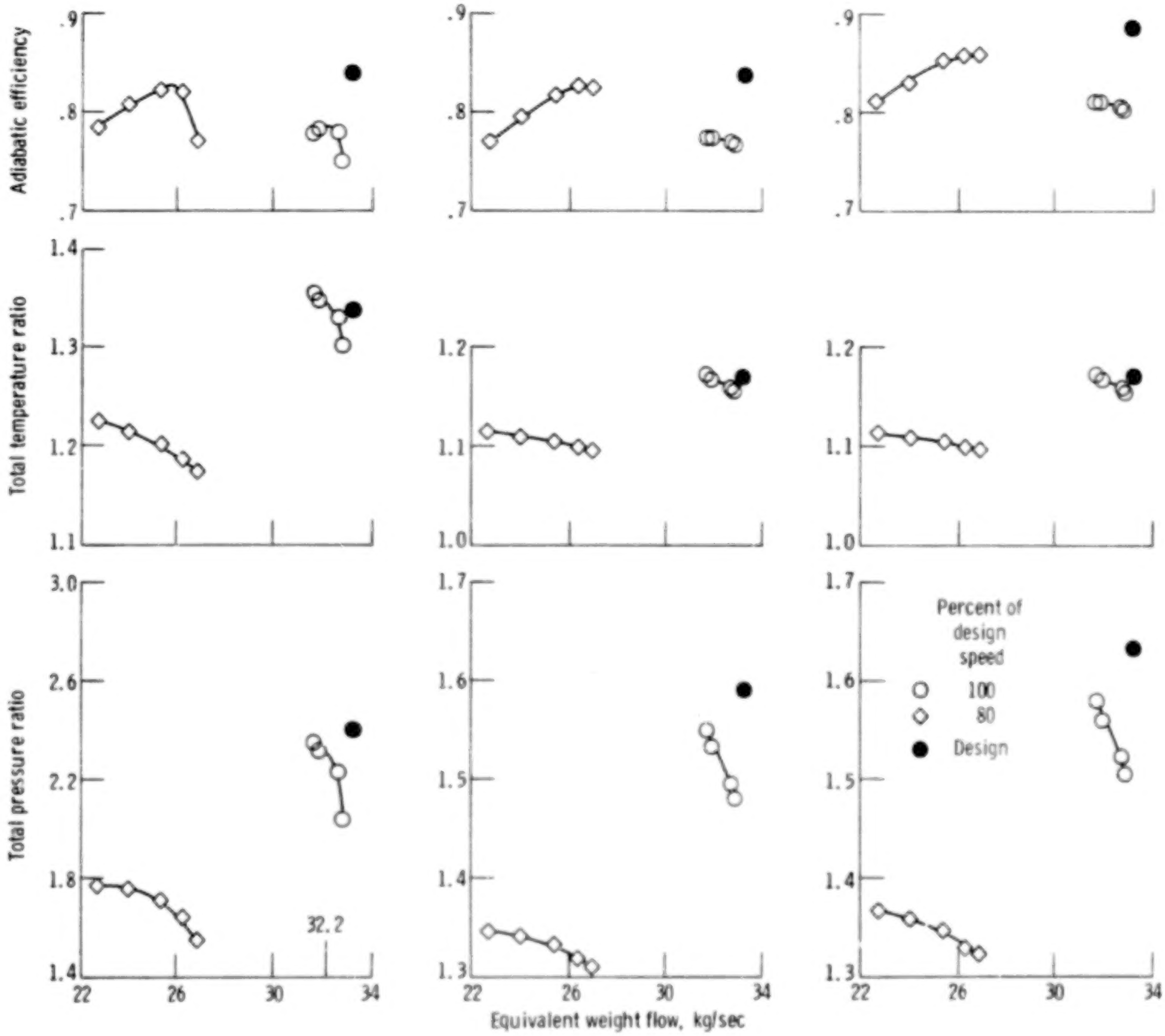


Figure 6. - Circumferential locations of combination probes (looking downstream; clockwise rotation).



(a) Two-stage fan.

(b) First stage.

(c) First-stage rotor.

Figure 7. - Overall performance.

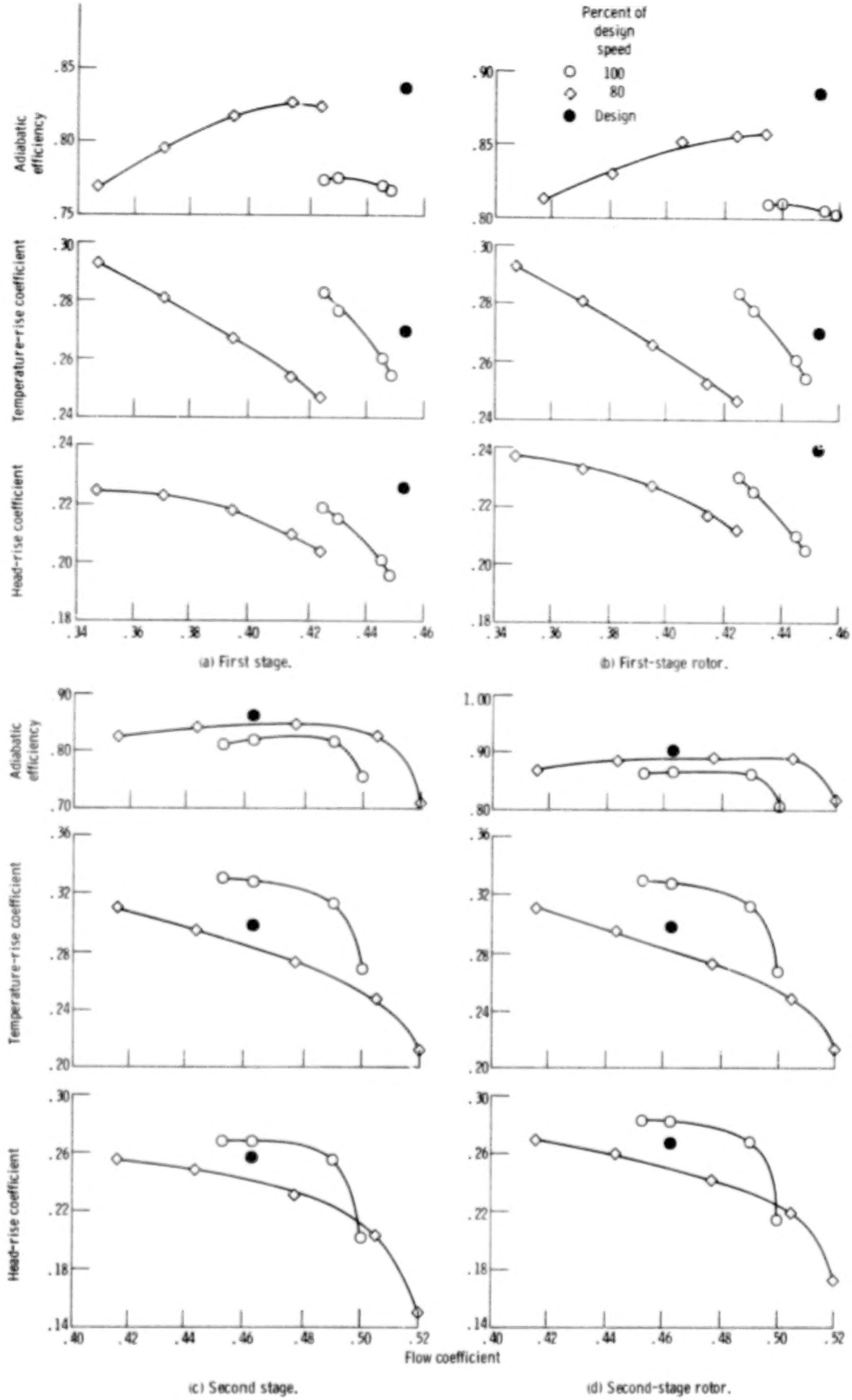
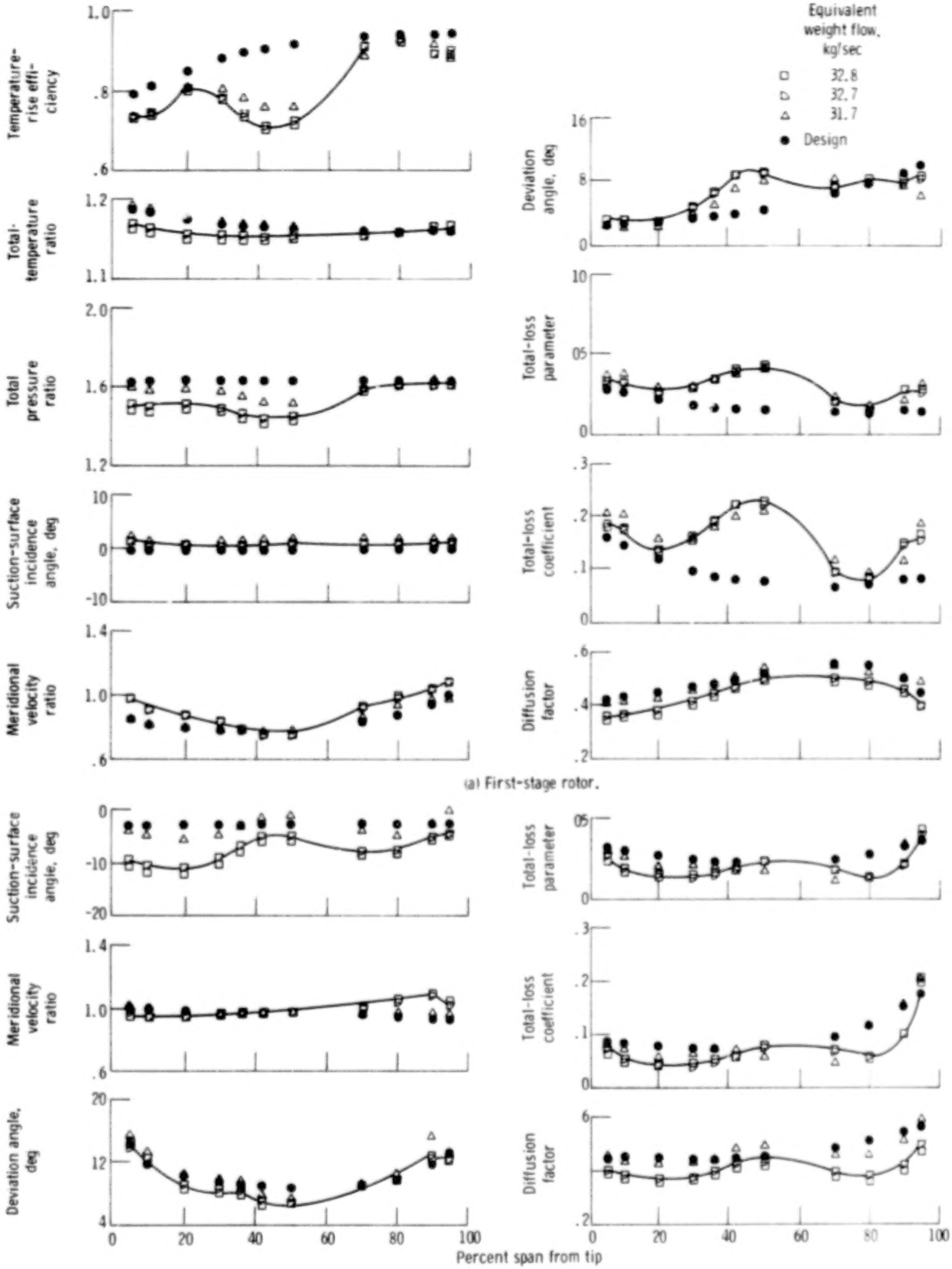


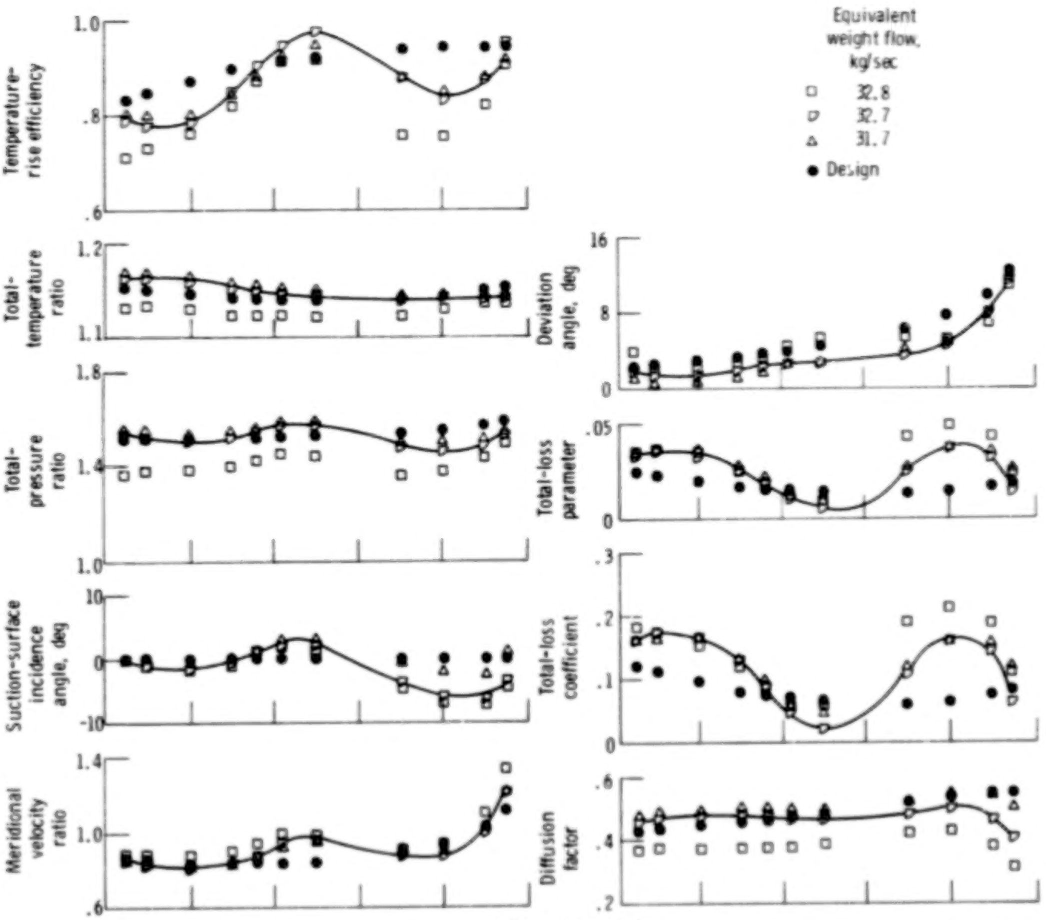
Figure 8. - Nondimensional overall performance.



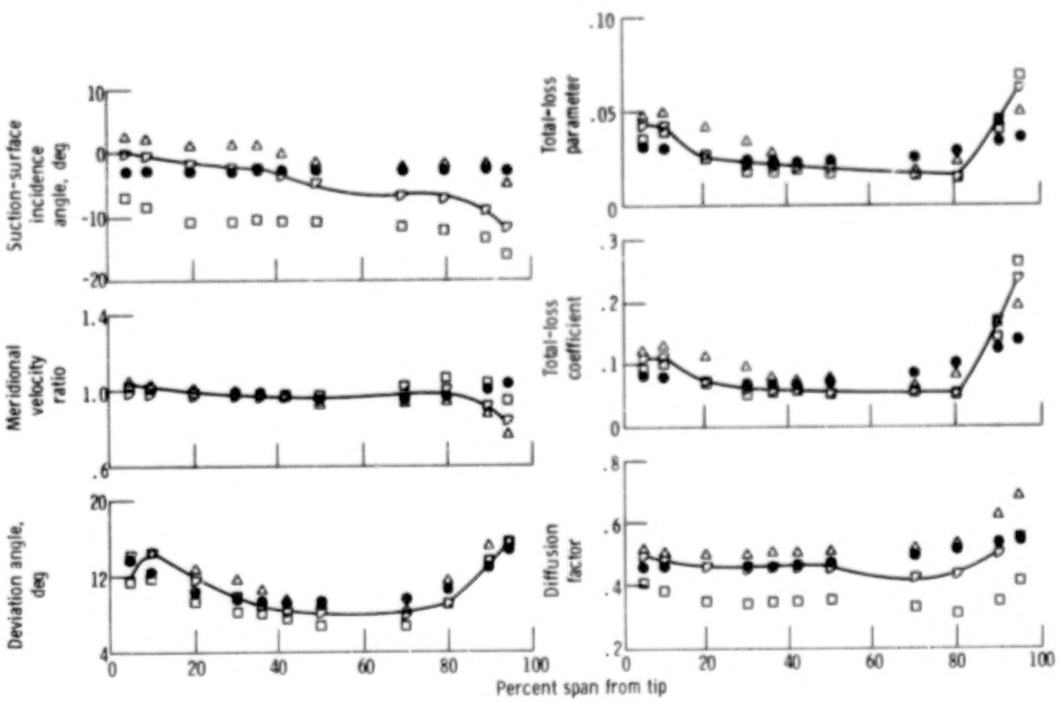
(a) First-stage rotor.

(b) First-stage stator.

Figure 9. - Radial distributions of performance parameters at design speed.



(c) Second-stage rotor.



(d) Second-stage stator.

Figure 9. - Concluded. Radial distributions of performance parameters at design speed.

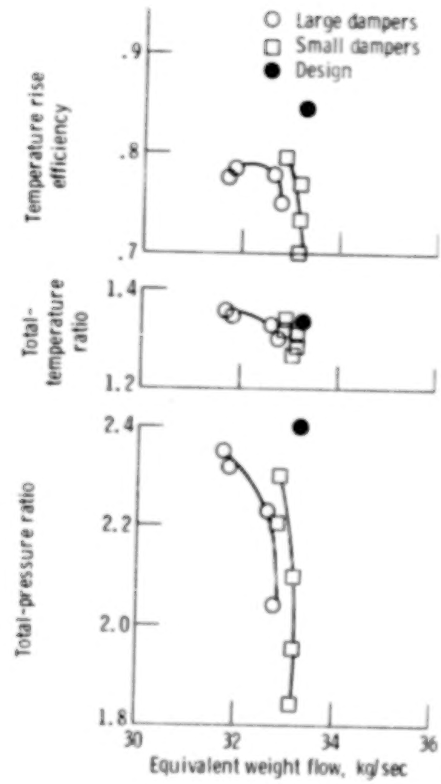
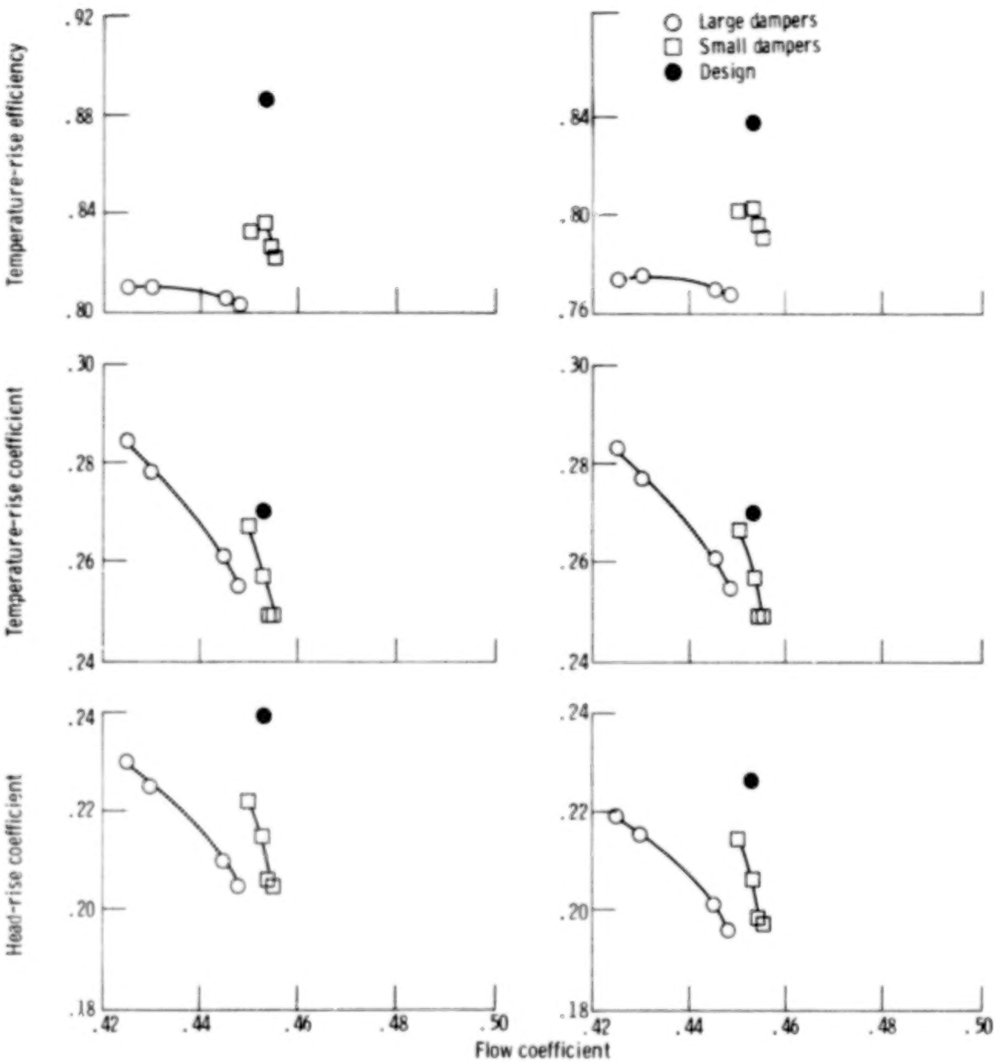


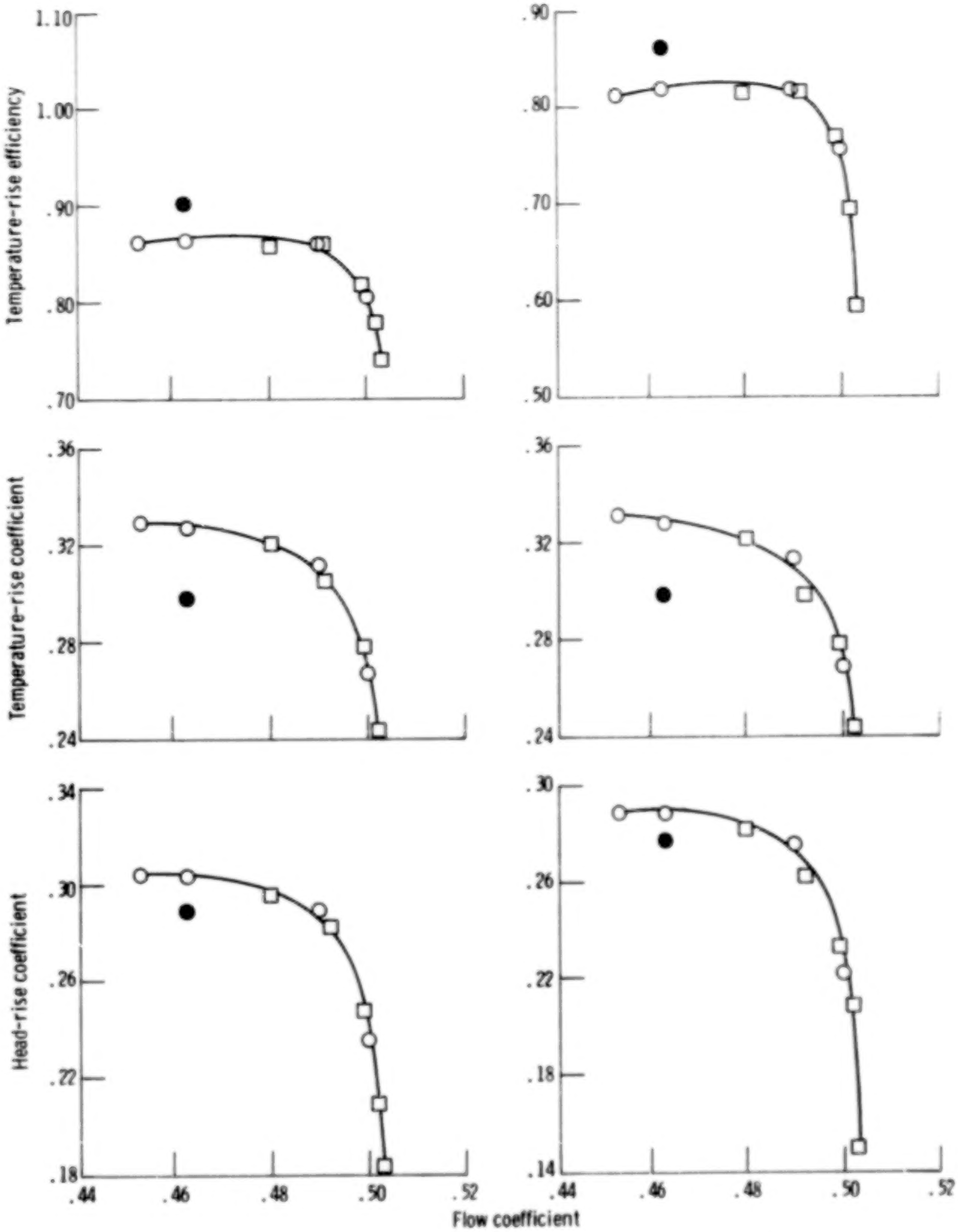
Figure 10. - Effect of damper size on overall performance.



(a) First-stage rotor.

(b) First stage.

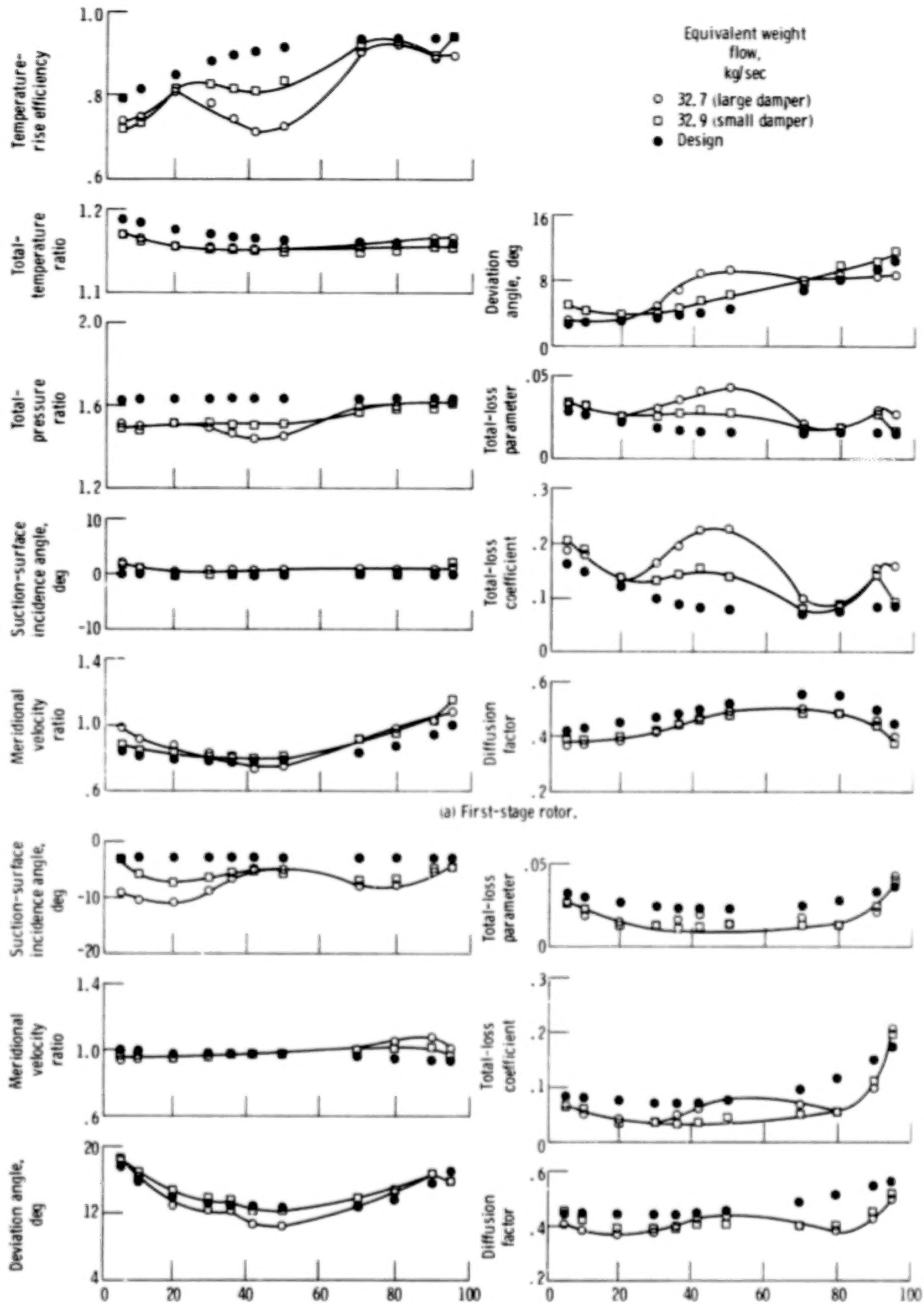
Figure 11. - Effect of damper size on nondimensional overall performance.



(c) Second-stage rotor.

(d) Second stage.

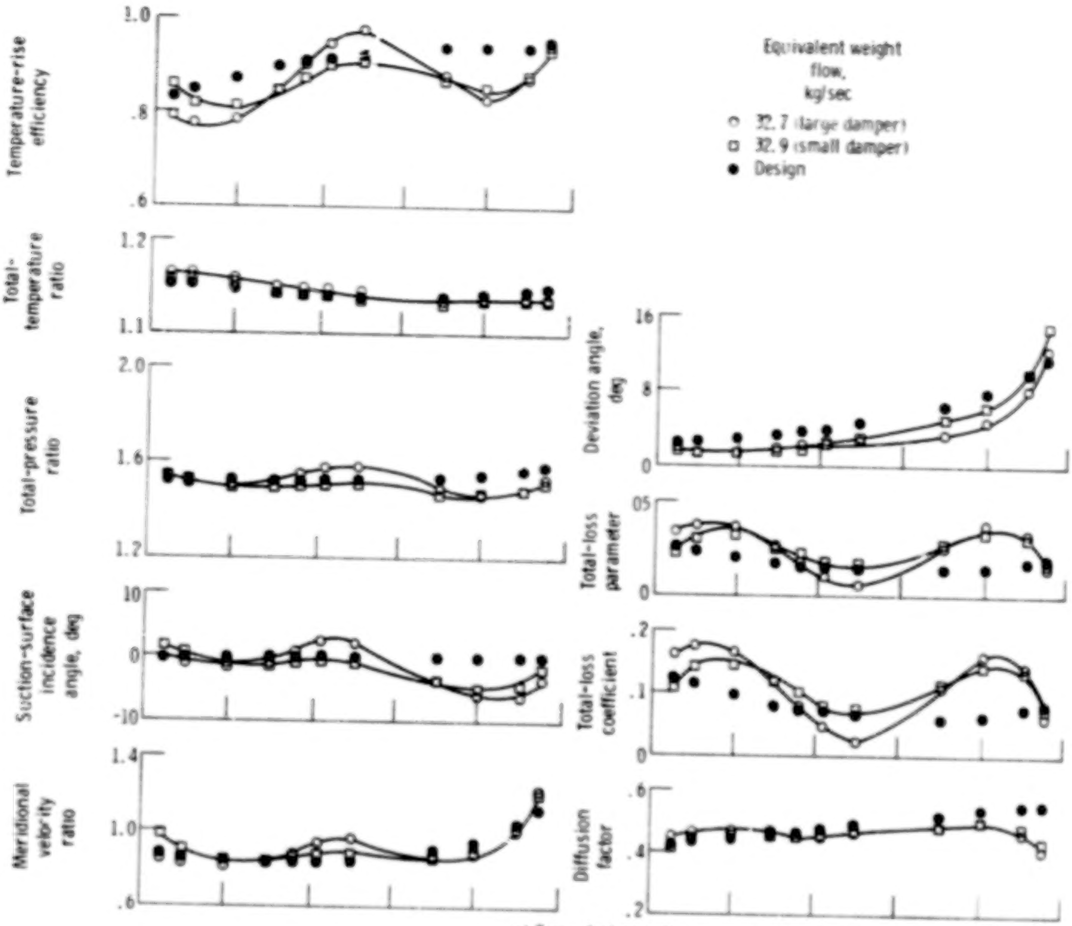
Figure 11. - Concluded.



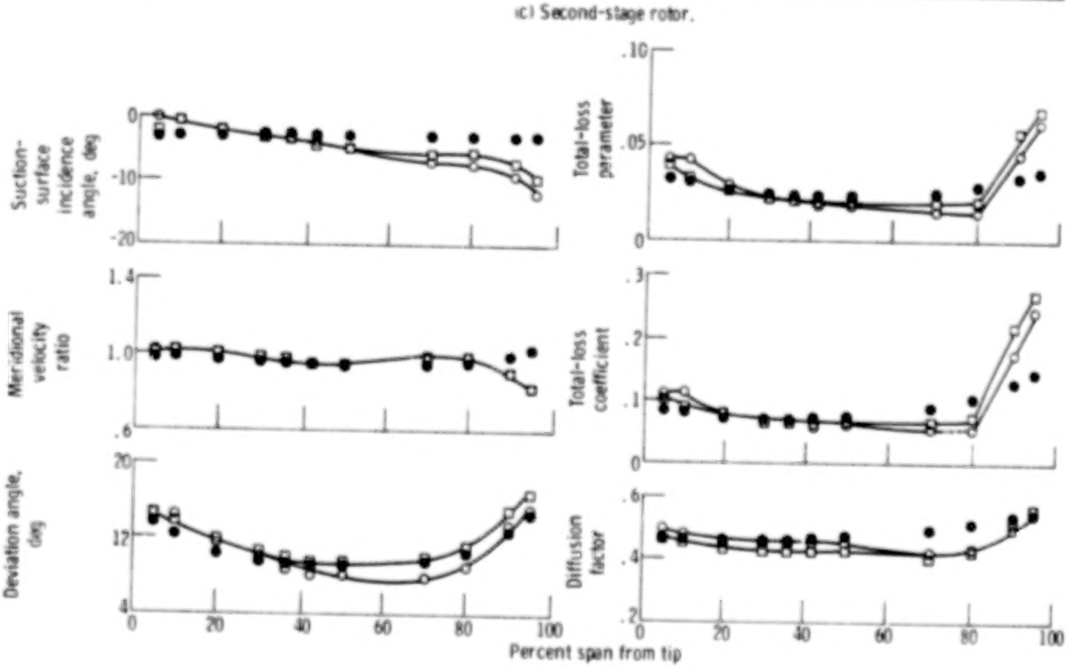
(a) First-stage rotor.

(b) First-stage stator.

Figure 12. - Effect of damper size on radial distributions of performance parameters at design speed.



(c) Second-stage rotor.



(d) Second-stage stator.

Figure 12. - Concluded. Effect of damper size on radial distributions of performance parameters at design speed.

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15. Supplementary Notes

16. Abstract

The performance of a two-stage, high-pressure-ratio fan, having large, part-span vibration dampers on the first-stage rotor is presented and compared with an identical aerodynamically designed fan having smaller dampers. Comparisons of the data for the two damper configurations show that with increased damper size (1) very high losses in the damper region reduced overall efficiency of first-stage rotor by approximately 3 points, (2) the overall performance of each blade row, downstream of the damper was not significantly altered, although appreciable differences in the radial distributions of various performance parameters were noted, and (3) the lower performance of the first-stage rotor decreased the overall fan efficiency more than 1 percentage point.

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